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Building Maintenance and Repair Data for Life-Cycle Cost Analyses: Architectural Systems

by
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FOREWORD

This research was conducted for the Directorate of Military Programs, Headquarters, U.S. Army Corps of Engineers (HQUSACE) and the Office of the Assistant Chief of Engineers under various research, development, testing, and evaluation (RDTE) and reimbursable funding documents. Work began under RDTE in 1980 and continued in reimbursable projects during 1984 through 1989. The technical monitor for the RDTE part was Dr. Larry Schindler (CEMP-EC) and for the reimbursable part was Ms. Val Corbridge (DAEN-ZCF-R).

The work was performed by the Facility Systems Division (FS), U.S. Army Construction Engineering Research Laboratory (USACERL). The Principal Investigators were Dr. Edgar Neely and Mr. Robert Neathammer (USACERL-FS). The primary contractor for much of the data development was the Department of Architectural Engineering, Pennsylvania State University. Dr. Michael O'Connor is Chief of USACERL-FS.

COL Everett R. Thomas is Commander and Director of USACERL, and Dr. L.R. Shaffer is Technical Director.

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1 INTRODUCTION

Background

Maintenance* and repair (M&R) cost estimates are needed during planning, design, and operations/maintenance of Army facilities. During planning, life-cycle costs are needed to evaluate alternative ways of meeting requirements (e.g., lease, new construction, renovate existing facilities). During design, M&R requirements for various types of components, such as built-up or shingle roofs, are needed so that the total life-cycle cost of different designs can be minimized. Finally, once the facility has been constructed, outyear predictions of maintenance and repair costs are needed so that enough funds can be programmed to ensure that Army facilities are maintained properly and do not deteriorate due to lack of maintenance.

The Directorate of Engineering and Construction (EC), Headquarters, U.S. Army Corps of Engineers (HQUSACE)**, asked the U.S. Army Construction Engineering Research Laboratory (USACERL) to coordinate the assembly of a single centralized maintenance and repair data base for use by Corps designers. This research was required because designers were not able to obtain reliable maintenance and repair data to support their life-cycle cost (LCC) analysis from installations or from the technical literature. One of the first tasks in the research effort was to determine if reliable data bases, which could be adapted for Corps use, existed in government or private industry. Comprehensive data bases of maintenance costs for government and private sector facilities did not exist. The little data available always depended on widely varying standards of maintenance used to maintain the facilities for which the data was collected and thus was unreliable for prediction purposes. Recognizing this, HQUSACE asked USACERL to develop a maintenance and repair cost data base. This data is for use by U.S. Army Corps of Engineers (USACE) designers in performing life-cycle cost analyses during the design of new facilities. Initial results were presented in several USACERL reports.[1]

Soon after this request, the Facilities Programming and Budgeting Branch of the Facilities Engineering Directorate asked USACERL to develop prediction models for outyear maintenance requirements of the Army facility inventory. The Programming Office of EC, responsible for Military Construction, Army (MCA) planning, also requested that USACERL provide methods and automated tools to help installations perform economic analyses. Part of the objective was to allow analysts to obtain future maintenance cost data.

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*Maintenance in this report means all work required to keep a facility in good operating condition; it includes all maintenance, repair, and replacement of components required over the life of a facility.

**At the time of this request, EC was part of the Office of the Chief of Engineers, which has since reorganized. In addition, EC has now become the Directorate of Military Programs.

[1] R.D. Neathammer, *Life-Cycle Cost Database Design and Sample Cost Data Development*, Interim Report P-120/ADA0997222 (U.S. Army Construction Engineering Research Laboratory [USACERL], February 1981); R.D. Neathammer, *Life-Cycle Cost Database: Vol I, Design*, and *Vol II, Sample Data Development*, Technical Report P-139/ADA126644 and ADA126645 (USACERL, January 1983), Appendices E through G.

In response to these requests, USACERL began a multiyear effort to develop a comprehensive maintenance and repair cost research program for buildings. This coordinated program is the key to all detailed estimation of future maintenance costs for Army facilities.

Research Performed and Reports Published

This is one of several interrelated reports addressing maintenance resource prediction in the facility life-cycle process. The total research effort is described in a USACERL Technical Report.[2]

The first research product was a data base containing maintenance tasks related to every building construction component. This data base provides labor, material, and equipment resource information. The frequency of task occurrence is also included. This information is published in a series of four USACERL Special Reports by engineering systems: (1) architectural, (2) heating, ventilating, and air-conditioning (HVAC), (3) plumbing, and (4) electrical. The title for the series is *Maintenance Task Data Base for Buildings* (the present report covers architectural systems for this series).[3] Table 1 shows an example from this data base. This data is also available in electronic form. The data base is used in a personal computer (PC) system under the Disk Operating System (DOS). This computer program allows a facility to be defined by entering the components and component quantities comprising the facility. The tasks are used to determine the resources required annually to keep the facility maintained.

The second research product was a component resource summary for the first 25 years of a facility. The tasks for the component were scheduled and combined into one set of annual resource requirements. This annual resource information is published in a series of four USACERL Special Reports titled *Building Component Maintenance and Repair Data Base*.[4] An example from this data base is shown in Table 2. The data base is also available in electronic form. This data can be used to perform special economic analyses such as one for a 20-year life using a 10 percent discount rate.

The third research product was a set of 25-year present worth factor tables for use by designers in selecting components for discount rates of 7 and 10 percent. The annual component resource values were multiplied by the appropriate present worth factor and added for the 25 years to produce one set of resource values. This information is published in a series of four USACERL Special Reports titled

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[2] E.S. Neely, R.D. Neathammer, J.R. Stirn, and R.P. Winkler, *Maintenance Resource Prediction in the Facility Life-Cycle Process*, Technical Report P-91/10 (USACERL, March 1991).

[3] E.S. Neely, R.D. Neathammer, J.R. Stirn, and R.P. Winkler, *Maintenance Task Data Base for Buildings. Heating, Ventilation, and Air Conditioning Systems*, Special Report P-91/21 (USACERL, May 1991), E.S. Neely, R.D. Neathammer, J.R. Stirn, and R.P. Winkler, *Maintenance Task Data Base for Buildings. Plumbing Systems*, Special Report P-91/18 (USACERL, May 1991), E S Neely, R.D. Neathammer, J.R. Stirn, and R.P. Winkler, *Maintenance Task Data Base for Buildings. Electrical Systems*, Special Report P-91/25 (USACERL, May 1991).

[4] E S Neely, R D. Neathammer, J.R. Stirn, and R.P. Winkler, *Building Component Maintenance and Repair Data Base for Buildings Architectural Systems*, Special Report P 91/27 (USACERL, May 1991), E. S. Neely, R. D. Neathammer, J.R. Stirn, and R P. Winkler, *Building Component Maintenance Data Base for Buildings. Heating, Ventilation, and Air-Conditioning Systems*, Special Report P-91/22 (USACERL, May 1991), E.S. Neely, R.D. Neathammer, J.R. Stirn, and R.P. Winkler, *Building Component Maintenance and Repair Data Base for Buildings. Plumbing Systems*, Special Report P-91/30 (USACERL, May 1991); E S Neely, R D Neathammer, J.R. Stirn, and R.P. Winkler, *Building Component Maintenance and Repair Data Base for Buildings: Electrical Systems*, Special Report P-91/19 (USACERL, May 1991).

Table 1

Typical Task Data Form

Task Code: 0311356

Component: SHINGLES System: ROOFING Subsystem: ROOF COVERING

Task Description: REPLACE NEW OVER EXISTING - SHINGLED ROOF

Unit of Measure: SQUARE FEET Frequency of Occurence: H: 18.00 A: 20.00 L: 22.00

Persons per Team: 2 Task Duration: 0.0150 hours Once every (H,A,L) years

Trade: ROOFER Task Classification: 1

Labor Resources

Subtask Description	Labor Hours
1. SET UP/SECURE/TAKE DOWN LADDER	0.000160
2. REPLACE WITH NEW SHINGLE	0.012887
3. CLEAN UP	0.010000

Material Resources

Description	Quantity	Unit Cost
SHINGLE	1.0 SF	0.2600
MASTIC	1.0 SF	0.1500
		0.4100

SUMMARY

Resources	Direct	Indirect	Total
Labor Hours	0.023047	0.006914	0.029961
Material Cost $	0.410000		0.410000
Equipment Hours			0.014981

Table 2

Typical Component Summary

CACES No.: 031134 - Roll Roofing / 031135 - Shingles

Labor Hours	Materials $	Equipment Hours	YR	Labor Hours	Materials $	Equipment Hours
0.0076	0.0165	0.0039	1	0.0024	0.0220	0.0013
0.0076	0.0165	0.0039	2	0.0024	0.0220	0.0013
0.0090	0.0165	0.0046	3	0.0026	0.0220	0.0014
0.0076	0.0165	0.0039	4	0.0024	0.0220	0.0013
0.0076	0.0165	0.0039	5	0.0032	0.0330	0.0017
0.0090	0.0165	0.0046	6	0.0026	0.0220	0.0014
0.0076	0.0165	0.0039	7	0.0024	0.0220	0.0013
0.0076	0.0165	0.0039	8	0.0024	0.0220	0.0013
0.0090	0.0165	0.0046	9	0.0026	0.0220	0.0014
0.0414	0.7496	0.0207	10	0.0032	0.0330	0.0017
0.0076	0.0165	0.0039	11	0.0024	0.0220	0.0013
0.0076	0.0165	0.0039	12	0.0026	0.0220	0.0014
0.0090	0.0165	0.0046	13	0.0024	0.0220	0.0013
0.0076	0.0165	0.0039	14	0.0024	0.0220	0.0013
0.0076	0.0165	0.0039	15	0.0034	0.0330	0.0018
0.0090	0.0165	0.0046	16	0.0024	0.0220	0.0013
0.0076	0.0165	0.0039	17	0.0024	0.0220	0.0013
0.0076	0.0165	0.0039	18	0.0026	0.0220	0.0014
0.0090	0.0165	0.0046	19	0.0024	0.0220	0.0013
0.0414	0.7496	0.0207	20	0.0332	0.4675	0.0167
0.0076	0.0165	0.0039	21	0.0026	0.0220	0.0014
0.0076	0.0165	0.0039	22	0.0024	0.0220	0.0013
0.0090	0.0165	0.0046	23	0.0024	0.0220	0.0013
0.0076	0.0165	0.0039	24	0.0026	0.0220	0.0014
0.0076	0.0165	0.0039	25	0.0032	0.0330	0.0017

All data is per square foot of roof area.

Building Maintenance and Repair Data for Life-Cycle Cost Analyses.[5] Table 3 shows an example from this data base. The data base is also available in electronic form. The first three resource columns provide data to allow designers to calculate the life-cycle costs at any location by multiplying by the correct labor rate, equipment rate, and material geographic factor. The multiplication and addition have been performed for the Military District of Washington, DC, and results are given in the fourth column of the table The right section of the table is information that can be entered into computer systems that perform life-cycle cost analysis.

[5] E S. Neely, R D. Neathammer, J.R. Stirn, and R.P. Winkler, *Building Maintenance and Repair Data for Life-Cycle Cost Analyses Heating, Ventilation, and Air Conditioning Systems*, Special Report P-91/20 (USACERL, May 1991), E.S. Neely, R D. Neathammer, J.R. Stirn, and R.P. Winkler, *Building Maintenance and Repair Data for Life-Cycle Cost Analyses. Plumbing Systems*, Special Report P 91/24 (USACERL, May 1991), E.S. Neely, R.D. Neathammer, J.R. Stirn, R.P. Winkler, *Building Maintenance and Repair Data for Life Cycle Cost Analyses. Electrical Systems*, Special Report P-91/26 (USACERL, May 1991).

Table 3

Life-Cycle Cost Analysis

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)													
COMPONENT DESCRIPTION		PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%)				PRESENT MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS							
		By Resources			Washington D.C. Total	Annual Maintenance and Repair			Replacement and High Costs Tasks				
	um	labor	material	equipment		labor	material	equipment	Yr	labor	material	equipment	
ARCHITECTURE													
ROOFING													
ROOF COVERING													
BUILTUP ROOFING	SF	0.03987	0.37166	0.01994	1.25	0.00487	0.03167	0.00244	28	0.04938	0.70490	0.02469	
PLACE NEW MEMBRANE OVER EXISTING–BUILDUP									14	0.02414	0.69960	0.01207	
MOD. BIT./THERMOPLASTIC	SF	0.02415	0.33069	0.01208	0.86	0.00245	0.03218	0.00123	20	0.05659	0.85860	0.02829	
THERMOSETTING	SF	0.01667	0.23941	0.00833	0.61	0.00173	0.02202	0.00086	20	0.03683	0.69960	0.01841	
SLATE	SF	0.01809	0.10432	0.00904	0.50	0.00253	0.01458	0.00126	70	0.06885	6.04200	0.03442	
CEMENT ASBESTOS	SF	0.01760	0.24341	0.00881	0.63	0.00246	0.03403	0.00123	70	0.05437	0.75190	0.02718	
TILE	SF	0.01519	0.20982	0.00759	0.54	0.00212	0.02933	0.00106	70	0.10169	3.07400	0.05084	
ROLL ROOFING	SF	0.07156	0.42684	0.03578	2.01	0.00757	0.01556	0.00378	10	0.04141	0.74963	0.02070	
SHINGLES	SF	0.02222	0.22132	0.01111	0.71	0.00262	0.02383	0.00131	40	0.04118	0.74497	0.02059	
REPLACE NEW OVER EXISTING–SHINGLED ROOF									20	0.02996	0.43460	0.01498	
METAL	SF	0.01422	0.11058	0.00711	0.42	0.00199	0.01546	0.00099	30	0.36265	2.17300	0.18132	
FIBERGLASS RIGID STP. ROOF	SF	0.02161	1.15262	0.01080	1.63	0.00228	0.06266	0.00114	20	0.04543	6.01550	0.02272	
CONCRETE, SEALED PANEL ROOF	SF	0.04260	0.11748	0.02131	1.05	0.00596	0.01642	0.00298	60	0.06123	24.07419	0.03061	
CONCRETE, SEALED PANEL RF4	SF	0.03950	0.08408	0.01974	0.96	0.00552	0.01175	0.00276	300	0.04342	24.07419	0.02171	
CONCRETE, SEALED POURED	SF	0.09872	0.62996	0.04936	2.81	0.01380	0.08807	0.00690	500	3.81056	18.03219	1.90528	
FIBERGLASS, RIGID ROOF	SF	0.03832	1.15262	0.01915	2.00	0.00468	0.06266	0.00234	20	0.04133	6.01550	0.02066	

A fourth research product was a PC system that allows facilities to be modeled by entering the components that comprise the facility. Future years resource predictions are produced by applying the individual tasks and then forming resource summaries by subsystems, systems, facilities, installations, reporting installations, Major Commands (MACOMS) and Army. A summary level computer system was also developed for use by the Department of the Army (DA) and MACOMS. The summary level system applies the most basic data contained in the current facility real property inventory files: (1) current facility use, (2) floor area, and (3) construction date. Users and systems manuals will be published as USACERL ADP Reports.

Objectives

The objective of this report is to describe the task development process for architectural systems and give examples for using these tasks.

Approach

The first activity in the research was to survey the literature for available maintenance data. No comprehensive task resource data base was located. The Navy has developed a series of manuals dealing with labor hours required to perform several basic maintenance tasks. This work has been adopted by the Department of Defense (DOD) for triservice use. A series of Technical Bulletins (TBs) under the general title *Engineered Performance Standards* (EPS) has been published.

The next activity was to survey USACE District offices to solicit their input for a data base. A guiding committee composed of District personnel, installation representatives, and private sector consultants met and agreed upon a general data base design. More importantly, they recommended that the data base be developed using the EPS rather than historical data.

Once the data base was developed, component summaries were created by summing all tasks for a component. These summaries were then input into a program that computed present worth values for each component.

The calculation procedures described in this report were performed and summarized for standard Army life-cycle analysis of 25 years with a 7 or 10 percent present worth factor Final results are published in the USACERL special report series *Building Maintenance and Repair Data Base for Life-Cycle Cost Analyses.*

Scope

The task data base is for DOD designers and can also be used by those in the private sector.

Mode of Technology Transfer

The tables pertinent to designer use will be issued as a supplement to Technical Manual (TM) 5-802-1, *Economic Studies for Military Construction Design—Applications.*

2 PROBLEM DEFINITION

In the facility life-cycle process, costs are incurred in construction, operation, maintenance, and disposal of a facility. Past emphasis during the planning, design, and construction phases has been on estimating initial construction costs. The impact of operating and maintaining facilities has always been a secondary consideration. In many cases, the operation and maintenance (O&M) costs are far greater than initial construction costs. Building owners are concerned with the total ownership costs of facilities rather than just the initial construction costs.

The Army has realized the importance of performing total life-cycle cost analyses for facilities at the design stage, and of accurately forecasting these costs for funds programming. HQUSACE asked USACERL in 1980 to develop a method of estimating future maintenance costs for buildings. In 1982, the programming branch of the former Facilities Engineering Directorate asked USACERL to develop effective models for forecasting facility maintenance resource requirements based on the actual facility.

Life-cycle cost economic studies are an integral part of facility design in the MCA program. Requirements for performing these studies are given in:

- Statutes, Code of Federal Regulations, and Executive Orders for performing analyses when energy is a key cost and for wastewater treatment plants

- USACE *Architectural and Engineering Instructions: Design Criteria*

- Army Regulation (AR) 11-28, *Economic Analysis and Program Evaluation for Resource Management* for general economic analyses.

- TM 5-802-1, *Economic Studies for Military Construction Design--Applications*

The main purpose of these studies is to minimize the life-cycle costs of Army facilities.

To perform life-cycle cost analyses on facility designs, three categories of costs are needed: initial, operating, and maintenance. Initial costs are usually easy to estimate through existing cost estimating systems such as the Corps of Engineers Computer Assisted Cost Estimating System (CACES) and standard publications such as Means or Dodge. Operating costs can be estimated by using energy consumption models such as the Corps of Engineers Building Loads Analysis and System Thermodynamics (BLAST) program or the Trane Company's Trace program. However, accurate estimates of maintenance costs are not available.

There are no comprehensive data bases of maintenance costs for building components either in the private sector or State/Federal Governments. Some historical data is available from the Building Owners' and Managers' Association reports. Within the Army, the Integrated Facilities System (IFS) contains some historical data; however, it does not have a feature for retaining several types of a building component (e.g., having brick and wood exteriors or three types of floor covering). Moreover, the data in IFS has not been kept current For example, at one installation several family housing units were shown as having wood siding when, in fact, they had been covered with aluminum siding several years earlier.

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estimates, and, more seriously, the production of accurate estimates. About this time, the Department of Defense directed that standards for work should be developed to the maximum feasible extent and applied throughout the military establishment. As a result of that directive, EPS were developed.

The Navy undertook a large research program to perform time and motion studies of maintenance personnel as they performed their maintenance tasks. After several years of effort, the Navy published the results under the title "Engineered Performance Standards." Both Army and Air Force maintenance personnel reviewed this set of manuals and adopted it for official use. Today, the EPS are used by all DOD agencies and are published as one set of reports carrying three different publication numbers for the Army, Navy, and Air Force.

Committee Reviews

At the beginning of this research project HQUSACE and USACERL formed an advisory committee composed of representatives from all offices involved in performing life-cycle cost analysis. The basic objective of the advisory committee was to involve as many appropriate and knowledgeable people as possible in deciding how to solve the M&R data base problem. The advisory committee reviewed the historical information research results and the EPS research program and reports. After lengthy discussion of all possible alternatives, the advisory committee decided to develop a maintenance task data base using the EPS as the basis for the labor resources. The advisory committee was active for the first 2 years of the project.

A second maintenance steering committee was formed that was composed of one representative from each HQDA office involved in maintenance resource programming and planning, six major commands, and 10 installations. This maintenance steering committee had the same basic objective as the first advisory committee. In addition, the steering committee wanted to use the data developed to predict actual maintenance resource requirements at installations.

Building Subdivision

The UNIFORMAT method of dividing a building into systems, subsystems, and components was adopted because it is used by all Federal construction agencies and many private organizations. Systems requiring little maintenance such as foundations and superstructure were not considered.

The level of component detail was determined by the members of the maintenance steering committee. This level varied, depending on the facility classification and the costs versus the benefit of collecting and maintaining data. For example, in the typical building the steering committee voted to stop at the door level and not define hardware requirements because the hardware was not a costly item, but for historical family housing, where one hinge could cost $200, all door hardware had to be defined.

Task Data Development

A task is defined as the work performed by a single trade. Each task is divided into the labor, material, and equipment resources required to perform the work. By separating the tasks in this manner the data can also be used to determine manpower staffing requirements and equipment requirements.

The following procedures have been used to develop the tasks for this research project. Identical procedures can be applied to develop new tasks not currently covered in the task data base.

The task development procedures can be demonstrated by using the existing task number 03111356, REPLACE NEW OVER EXISTING SHINGLED ROOF, shown in Table 1. This task involves gaining access to the roof, placing a new layer of shingles over an existing single-layer shingle roof, and cleaning up the area.

The first step is to obtain a copy of DA Pamphlet 25-30, *Consolidated Index of Army Publications and Blank Forms*. A list of the current TBs covering EPS is given in Appendix C. Review this list to determine which TBs seem to address the task to be developed. The TBs can be obtained from your library or from:

Naval Publications and Forms Center
5801 Tabor Ave.
Philadelphia, PA 19120.

Once the TBs are available, the second step is to review the Table of Contents of each to determine if tasks related to the component are covered in the bulletin. If the tasks to be developed are covered by the bulletin, review the tasks to determine if the data given can be applied to the task under development. When tasks related to the new component tasks under development are not covered by EPS, other sources such as estimating books and manuals, national standards, trade publications, and manufacturer data must be researched. It is important to provide a complete list of such materials. A reference librarian can provide resources addressing a specific component.

The roofs of most one to three story buildings are accessed by ladder. A review of the EPS subtasks revealed a standard EPS subtask that covers moving the ladder and moving up and down the ladder. One reference to this standard subtask is in TB 420-4 (p 180), Task CT-159, subtask 9, move, climb up and down ladder, as duplicated in Table 4. The labor rate is given as 0.207 hr/job. It was assumed that the ladder would be moved every 1300 sq ft to provide faster access to the work area. Transforming this number into a rate per square foot of roof area would produce 0.207 hr/job/1300 sq ft/job = 0.000160 hr/sq ft.

TB 420-4 contains no single task for placing a new layer of shingles over an old layer. However, Task CT-416, subtask 3 (p 295 in the TB), shown in Table 5, would be almost the same duration. The labor rate would therefore be 0.012887 hr/sq ft.

Some cleanup will be required after placing the shingles. The EPS showed no subtask directly related to this type of cleanup, but a cleanup subtask was found in the masonry handbook, TB 420-14 (p 112), DT-213, subtask 4. The cleanup was estimated to be approximately 20 percent of the resources listed for this subtask, or 0.01 hr/sq ft.

The total direct labor hours to perform the entire job would be the sum of all subtasks, or 0.02305 hr/sq ft. The indirect time or the time to plan the work, load the truck at the beginning of the day, unload

Table 4

Task CT-159*

No.	Reference	Work Unit Description	Hours	Units
1	PWMU-1-8352	Measure, mark and check measurement	0.13120	Job
2	PWC-19-XXI	Remove and reinstall cement shingles	0.02374	Job
		No. of locations = 1	0.14430	Job
		No. of shingles removed = 6	0.20040	Job
		No. of shingles installed = 6		
3	PWC-15-II	Drill holes for cutting wall	0.03080	Job
		No. of holes drilled = 2	0.03328	Job
4	PWC-15-I	Measure, mark and cut in opening and framing lumber	0.15426	Job
		No. of 8 sq. in. cuts = 47	0.70406	Job
5	PWMU-1-8107	Position framing lumber, trim and rain cap	0.19720	Job
6	PWC-16-XV	Level and align framing	0.10224	Job
7	PWC-16-XVI	Nail pieces (framing, trim, rain cap)	0.00765	Job
		No. of nails = 72	0.18000	Job
8	PWC-16-XXXII	Caulk around exterior frame	0.00327	Job
		No. lin. ft. of caulking = 9	0.01530	Job
9	PWMU-1-8052	Move, climb up and down ladder	0.20700	Job
10	PWA-5-II	Material handling	0.10359	Job

*CT-159: Air Conditioner, Opening for, Cut in and Frame Opening in Exterior Wall. Wall has cement shingle and gypsum wallboard interior. CT-159 = 2.23828 hr/job.

Table 5

Task CT-416*

No.	Reference	Work Unit Description	Hours	Units
1	PWU-30X	Remove asphalt shingles	0.65795	100 sq ft
2	PWU-3-I	Install one layer 30# felt on wood deck	0.20499	100 sq ft
3	PWU-3-II	Install asphalt shingles with adhesive on wood deck, shingles 12" x 36" with 5" exposure	1.28871	100 sq ft

*CT-416: Shingles (Asphalt), Remove and Install with 30# Felt. No. of Squares; 1 Square = 100 sq ft.
CT-416 - 2,15165 hr/100 sq ft.

the truck at the end of the day, personal time, delay time, and material handling time must be included to obtain the total onsite labor time. In EPS, this value is expressed as a percentage of the direct labor. When all factors have been considered, the direct labor should be increased by 30 percent or 0.00691 hr/sq ft.

The steering committee wanted to apply the same material costs for all planning, programming, design, construction, and operations activities. For this research project, all material costs were developed using prices in the Washington, DC area. Material prices for exact locations throughout the world can be obtained by multiplying the Washington, DC area costs by the appropriate location adjustment factor published in a Programming, Administration, and Execution System (PAX) Newsletter under the title "Area Cost Factor Indexes." Copies of the 22 September 1988 indexes are given in Appendix D, Geographical Location Adjustment Factors. Tl :ACES *Unit Price Book* for Region II dated July 1, 1985 has been used for all costs and can be obtainc from the Corps District Cost Estimating Section.

In reviewing material prices, there will usually be many grades listed for the component in question. Since only one entry for the component task will be made for the maintenance data base, it is important to use the middle grade for pricing. This will produce an average material cost.

When materials are not given in the CACES manuals, other material pricing manuals, such as Means, should be used to determine the cost.

The material cost for the shingles, \$0.26/sq ft, was taken from the *CACES Unit Price Book for Region II* as cited above. The CACES number is 0751-1002. The cost for the mastic was taken from the *1985 Means Handbook*, p 402, circle number 94. This task required 25 percent of the mastic reported in the Means task. The calculation is: 2.45 lb/sq ft x \$490/ton/2000 lb/ton = \$0.59976/sq ft. For a single-ply roof, this value is \$0.59976/4 = \$0.15/sq ft.

The normal equipment cost is for a maintenance truck with all required tools such as ladders and hand tools. The cost for the truck and equipment is usually based on task duration.

Task frequency determination is the most subjective area in the data base. Most frequencies must be determined by the judgment of professional maintenance personnel with many years of experience in performing the maintenance tasks. Some task frequencies are suggested by the manufacturer or professional organizations. Some frequencies, such as for interior wall painting, are set by regulations. There is very little published information in this area.

The data base has been reviewed by 10 installation Directorates of Engineering and Housing (DEHs) and has been determined to accurately represent the resources required to perform the tasks. This data base serves as the foundation for the tables published in this report. The complete data base is too large to be duplicated in this report, but is available in the USACERL Special Report series titled *Maintenance Task Data Base for Buildings*.

The maintenance steering committee asked Forts Leonard Wood and Bragg to use the tasks to produce resource estimates for the past 3 years and then compare the predictions with their actual expenditures on a facility-by-facility basis. After this comparison was performed by both installations, the results were presented to the steering committee. Both installations stated that they were not performing all the tasks that they should, such as annual gutter cleaning and annual roof inspection. For the total installation, the tasks predicted an 8 to 10 percent higher total expenditure than the actual expenditure. This difference was due to the difference between the tasks predicted and actually performed. When comparisons were made at the task level, the task resource predictions were found to be accurate.

Two additional reviews were performed by two independent organizations that had related research work in the Army. The first review was for a research project to determine the maintenance requirements for historical family housing within the Military District of Washington, DC. The second review was a research project which needed an estimate of all resource requirements for the entire Army. This effort is known as the RPLANS research project. Both organizations reviewed the data base in detail and approved the resource requirements stated in the tasks. In addition, both used the data base within their research projects.

Significance of the Task Data

The task data presented in the previous section is based on average resources. Actual resource values for a particular project will vary as discussed below.

The labor hours reported will vary, depending on factors such as the actual productivity of the workers, the weather conditions, and the working space available. The labor hours given in this report are based on the average obtained from performing time and motion studies as tasks were performed.

The Washington, DC, material costs will vary, depending on factors such as the grade of material actually used, the manufacturer, and the quantity of material actually purchased. The figures given are the averages for all material prices found in the unit price books.

Task frequencies are the most subjective feature in the data base. High, average, and low frequency values are given to emphasize the variances. Average frequencies are used in developing the life-cycle analysis tables presented in the following sections.

Component Summary Tables

A typical component summary is shown in Table 2 (Chapter 1). The development process is illustrated by using the labor resource for the shingle roof component.

All tasks related to the shingle roof component are listed individually in Table 6, with a task summary in Table 7. The task average frequency is used to project times of occurrence of M&R tasks for the first 25-year period as shown in Table 8. All task resources are expressed per square foot of roof surface.

The first task (Task 1 - 0311351 - Debris Removal by Hand and Visual Inspection) has an average frequency (AVE FREQ in Table 6) of 1.00 years; thus, it would be performed each year. The labor hours (0.000754 in Table 6) are listed for each of the 25 years in the second column of Table 8.

The second task (Task 2 - 0311352 - Non-Destructive Moisture Inspection) has an average frequency from Table 6 of 3.00 years; thus, it would be performed once every 3 years. The labor hours (0.000234 in Table 6) are listed for the years 3, 6, 9, 12, 15, 18, 21, and 24 in the third column of Table 8.

The third task (Task 3 - 0311353 - Minor Repairs) has an average frequency of 1 year; thus it would be performed each year. The labor hours (0.001310 in Table 6) are listed for each of the 25 years in the fourth column of Table 8.

The fourth task (Task 4 - 0311354 - Minor Replacement) has an average frequency of 5 years; thus, it would be performed once every 5 years. The labor hours (0.000822) are listed for years 5, 10, 15, 20, and 25 in the fifth column of Table 8.

The fifth task (Task 5 - 0311355 - Flashing Repairs) has an average frequency of 1 year; thus, it would be performed each year. The labor hours (0.000348 in Table 6) are listed for each year in the sixth column of Table 8.

The sixth task (Task 6 - 0311356 - Replace New Over Existing Shingles) has an average frequency of 20 years; thus, it would be performed every 20 years. The labor hours (.029961 in Table 6) are listed for year 20 in the seventh column.

The seventh task (Task 7 - 0311357 - Removal and Replacement of Shingled roof) has an average frequency of 40 years which is beyond the 25-year study period. No entries are made in column eight of Table 8 since this task will never be performed within the study period.

The total column in Table 8 is formed by adding the labor hours for tasks one through seven on a year-by-year basis. For example, during the third year, Tasks 1, 2, 3, and 5 are performed. The total labor hours would be .000754 + .000234 + .001310 + .000348 which equals 0.002646.

The total column in Table 8 is shown in Table 2. The material costs and equipment hours have been developed in the same manner as explained for the labor hours.

Table 6

Tasks for a Shingle Roof

TASK DATA FORM

Task Code: 0311351

Component: SHINGLES   System: ROOFING   Subsystem: ROOF COVERING
Task Description: DEBRIS REMOV.BY HAND & VIS. INSP.-SHINGLED ROOF
Unit of Measure: SQUARE FEET   Frequency of Occurrence: H: 0.90 A: 1.00 L: 1.10
Persons per Team: 2   Task Duration: 0.0004 hours   Once every (H,A,L) years
Trade: ROOFER   Task Classification: 0

Labor Resources

Subtask Description	Labor Hrs
1.SET UP/SECURE/TAKE DOWN LADDER	0.000080
2.PICK UP TRASH/DEBRIS,INSPECTION	0.000500

Material Resources

Description	Quantity	Unit Cost
		0.0000

SUMMARY

Resources	UOM	Direct	Indirect	Total
Labor	Hours	0.000580	0.000174	0.000754
Material	Cost $	0.000000		0.000000
Equipment	Hours			0.000377

Components In This Task: 0311350

TASK DATA FORM

Task Code: 0311352

Component: SHINGLES   System: ROOFING   Subsystem: ROOF COVERING
Task Description: NON-DESTRUCTIVE MOISTURE INSP. - SHINGLED ROOF
Unit of Measure: SQUARE FEET   Frequency of Occurrence: H: 2.00 A: 3.00 L: 4.00
Persons per Team: 2   Task Duration: 0.0001 hours   Once every (H,A,L) years
Trade: ROOFER   Task Classification: 0

Labor Resources

Subtask Description	Labor Hrs
1.SET UP/SECURE/TAKE DOWN LADDER	0.000080
2.ONSITE INSPECT.OF ROOF MEMBRANE	0.000100

Material Resources

Description	Quantity	Unit Cost
		0.0000

SUMMARY

Resources	UOM	Direct	Indirect	Total
Labor	Hours	0.000180	0.000054	0.000234
Material	Cost $	0.000000		0.000000
Equipment	Hours			0.000117

Components In This Task: 0311350

Table 6 (Cont'd)

TASK DATA FORM

Task Code: 0311353

Component: SHINGLES System: ROOFING Subsystem: ROOF COVERING
Task Description: MINOR REPAIRS - SHINGLED ROOF
Unit of Measure: SQUARE FEET Frequency of Occurrence: H: 0.75 A: 1.00 L: 1.25
Persons per Team: 2 Task Duration: 0.0007 hours Once every (H,A,L) years
Trade: ROOFER Task Classification: 0

Labor Resources

Subtask Description	Labor Hrs
1.SET UP/SECURE/TAKE DOWN LADDER	0.000160
2.REMOVAL OF ADJACENT SHINGLES	0.000570
3.INSTALL SHINGLES	0.000258
4.CLEAN UP	0.000020

Material Resources

Description	Quantity	Unit Cost
SHINGLES	0.02 SF	0.2600
MASTIC	0.02 SF	0.1500
		0.0082

SUMMARY

Resources	UOM	Direct	Indirect	Total
Labor	Hours	0.001008	0.000302	0.001310
Material	Cost $	0.008200		0.008200
Equipment	Hours			0.000655

Components In This Task: 311350

TASK DATA FORM

Task Code: 0311354

Component: SHINGLES System: ROOFING Subsystem: ROOF COVERING
Task Description: MINOR REPLACEMENT - SHINGLED ROOF
Unit of Measure: SQUARE FEET Frequency of Occurrence: H: 4.00 A: 5.00 L: 6.00
Persons per Team: 2 Task Duration: 0.0004 hours Once every (H,A,L) years
Trade: ROOFER Task Classification: 0

Labor Resources

Subtask Description	Labor Hrs
1.SET UP/SECURE/TAKE DOWN LADDER	0.000160
2.REMOVAL OF DAMAGED SHINGLES	0.000130
3.INSTALL SHINGLES	0.000322
4.CLEAN UP	0.000020

Material Resources

Description	Quantity	Unit Cost
MASTIC	0.025 SF	0.1500
SHINGLES	0.025 SF	0.2600
		0.0103

SUMMARY

Resources	UOM	Direct	Indirect	Total
Labor	Hours	0.000632	0.000190	0.000822
Material	Cost $	0.010250		0.010250
Equipment	Hours			0.000411

Components In This Task: 0311350

Table 6 (Cont'd)

TASK DATA FORM

Task Code: 0311355

Component: SHINGLES System: ROOFING Subsystem: ROOF COVERING
Task Description: FLASHING REPAIRS - SHINGLED ROOF
Unit of Measure: SQUARE FEET Frequency of Occurrence: H: 0.75 A: 1.00 L: 1.25
Persons per Team: 2 Task Duration: 0.0002 hours Once every (H,A,L) years
Trade: ROOFER Task Classification: 0

Labor Resources

Subtask Description	Labor Hrs
1.SET UP/SECURE/TAKE DOWN LADDER	0.000160
2.REMOVE ADJOINING SHINGLES	0.000057
3.REMOVE STEP FLASHING	0.000002
4.INSTALL NEW STEP FLASHING	0.000003
5.PLACE NEW SHINGLES IN POSITION	0.000026
6.CLEAN UP	0.000020

Material Resources

Description	Quantity	Unit Cost
FLASHING	0.02 SF	0.6300
		0.0126

SUMMARY

Resources	UOM	Direct	Indirect	Total
Labor	Hours	0.000268	0.000080	0.000348
Material	Cost $	0.012600		0.012600
Equipment	Hours			0.000174

Components In This Task: 0311350

TASK DATA FORM

Task Code: 0311356

Component: SHINGLES System: ROOFING Subsystem: ROOF COVERING
Task Description: REPLACE NEW OVER EXISTING - SHINGLED ROOF
Unit of Measure: SQUARE FEET Frequency of Occurrence: H: 18.00 A: 20.00 L: 22.00
Persons per Team: 2 Task Duration: 0.0150 hours Once every (H,A,L) years
Trade: ROOFER Task Classification: 1

Labor Resources

Subtask Description	Labor Hrs
1.SET UP/SECURE/TAKE DOWN LADDER	0.000160
2.REPLACE WITH NEW SHINGLE	0.012887
3.CLEAN UP	0.010000

Material Resources

Description	Quantity	Unit Cost
SHINGLE	1.0 SF	0.2600
MASTIC	1.0 SF	0.1500
		0.4100

SUMMARY

Resources	UOM	Direct	Indirect	Total
Labor	Hours	0.023047	0.006914	0.029961
Material	Cost $	0.410000		0.410000
Equipment	Hours			0.014981

Components In This Task: 0311350

Table 6 (Cont'd)

TASK DATA FORM

Task Code: 0311357

Component: SHINGLES System: ROOFING Subsystem: ROOF COVERING
Task Description: REMOVAL AND REPLACEMENT OF SHINGLES-SHINGLED ROOF
Unit of Measure: SQUARE FEET Frequency of Occurrence: H: 36.00 A: 40.00 L: 44.00
Persons per Team: 2 Task Duration: 0.0206 hours Once every (H,A,L) years
Trade: ROOFER Task Classification: 1

Labor Resources

Subtask Description	Labor Hrs
1.SET UP/SECURE/TAKE DOWN LADDER	0.000160
2.REMOVE EXISTING SHINGLES	0.006580
3.INSTALL 1 PLY BASE FELT NAILED	0.002050
4.INSTALL SHINGLES	0.012887
5.CLEAN UP	0.010000

Material Resources

Description	Quantity	Unit Cost
BASE FELT	1.0 SF	0.4428
SHINGLES	1.0 SF	0.2600
		0.7028

SUMMARY

Resources	UOM	Direct	Indirect	Total
Labor	Hours	0.031677	0.009503	0.041180
Material	Cost $	0.702800		0.702800
Equipment	Hours			0.020590

Components In This Task: 0311350

Table 7

Task Summary Data for Shingle Roof

CACES	DESCRIPTION 0311350 SHINGLES	UM	TRD	CLASS	HIGH FREQ	AVE FREQ	LOW FREQ	LABOR HOURS	MATERIAL COSTS	EQUIPMENT HOURS
0311351	DEBRIS REMOV. BY HAND & VIS. INSP. - SHINGLE	2	17	0	0.90	1.00	1.10	0.000754	0.000000	0.000377
0311352	NON-DESTRUCTIVE MOISTURE INSP. - SHINGLE	2	17	0	2.00	3.00	4.00	0.000234	0.000000	0.000117
0311353	MINOR REPAIRS - SHINGLED ROOF	2	17	0	0.75	1.00	1.25	0.001310	0.008200	0.000655
0311354	MINOR REPLACEMENT - SHINGLED ROOF	2	17	0	4.00	5.00	6.00	0.00822	0.010250	0.000411
0311355	FLASHING REPAIRS - SHINGLED ROOF	2	17	0	0.75	1.00	1.25	0.000348	0.012600	0.000174
0311356	REPLACE NEW OVER EXISTING - SHINGLED RFG.	2	17	1	18.00	20.00	22.00	0.029961	0.410000	0.014981
0311357	REMOVAL & REPLACEMENT OF SHINGLED ROOF	2	17	1	36.00	40.00	40.00	0.041180	0.702800	0.020590

Army Wide Task/Basic Task Structure List
Tree id: BF
Group id: B5
UM = Unit of Measure
TRD = Trade Index
Class = Task Classification
TWPMTH = Task Work Performance Method

Table 8

Shingle Roof Spreadsheet—Labor Hours

YEAR	TASK1 0311351	TASK2 0311532	TASK3 0311353	TASK4 0311354	TASK5 0311355	TASK6 0311356	TASK7 0311357	TOTAL LABOR HRS	10% P.W.F.	P. W. LABOR HOURS
1	0.000754		0.001310		0.000348			0.002412	0.7164	0.001728
2	0.000754		0.001310		0.000348			0.002412	0.6512	0.001571
3	0.000754	0.000234	0.001310		0.000348			0.002646	0.5920	0.001566
4	0.000754		0.001310		0.000348			0.002412	0.5382	0.001298
5	0.000754		0.001310	0.000822	0.000348			0.003234	0.4893	0.001582
6	0.000754	0.000234	0.001310		0.000348			0.002646	0.4448	0.001177
7	0.000754		0.001310		0.000348			0.002412	0.4044	0.000975
8	0.000754		0.001310		0.000348			0.002412	0.3676	0.000887
9	0.000754	0.000234	0.001310		0.000348			0.002646	0.3342	0.000884
10	0.000754		0.001310	0.000822	0.000348			0.003234	0.3038	0.000982
11	0.000754		0.001310		0.000348			0.002412	0.2762	0.000666
12	0.000754	0.000234	0.001310		0.000348			0.002646	0.2511	0.000664
13	0.000754		0.001310		0.000348			0.002412	0.2283	0.000551
14	0.000754		0.001310		0.000348			0.002412	0.2075	0.000500
15	0.000754	0.000234	0.001310	0.000822	0.000348			0.003468	0.1886	0.000654
16	0.000754		0.001310		0.000348			0.002412	0.1715	0.000414
17	0.000754		0.001310		0.000348			0.002412	0.1559	0.000376
18	0.000754	0.000234	0.001310		0.000348			0.002646	0.1417	0.000375
19	0.000754		0.001310		0.000348			0.002412	0.1288	0.000311
20	0.000754		0.001310	0.000822	0.000348	0.029961		0.033195	0.1171	0.003887
21	0.000754	0.000234	0.001310		0.000348			0.002646	0.1065	0.000282
22	0.000754		0.001310		0.000348			0.002412	0.0968	0.000233
23	0.000754		0.001310		0.000348			0.002412	0.0880	0.000212
24	0.000754	0.000234	0.001310		0.000348			0.002646	0.0800	0.000212
25	0.000754		0.001310	0.000822	0.000348			0.003234	0.0727	0.000235
									TOTAL	0.022224

The component data base is not printed in this report because of its size. Component summary data tables are published in the USACERL Special Report series titled *Maintenance Component Data Base for Buildings*.

Life-Cycle Cost Analysis Tables

The main purpose of this report is to provide the designer with easy-to-use tables for the most common life-cycle cost analysis. USACE designers frequently perform life-cycle cost analysis for a 25-year period using a 7 or 10 percent discount rate shown in Tables 9 and 10. Two sets of summary tables have been generated for these cases and are given in Appendices A and B. Table 3 shows typical life-cycle cost analysis data.

Present Worth. The left four columns of Table 3, labeled "Present Worth of All 25-Year Maintenance and Repair Costs," were developed by multiplying the resources in Table 2 by the 7 or 10 percent present worth factors shown in Tables 9 and 10. The 25 individual year resource figures are totaled as shown for labor in Table 8.

The 1988 Washington, DC area labor and equipment rates were applied to this data to produce the totals shown in the column so titled. This column is given to provide one comparative cost figure for easy computation. This column can be used to quickly assess the ranking of various components' total 25-year LCC.

Annual and High Cost. The right section of Table 3 is provided as input data for current life-cycle cost analysis computer programs. Two types of input are usually required: (1) a uniform or annual maintenance figure and (2) high-cost and replacement tasks that occur in specific years.

The data listed under the heading "Annual Maintenance and Repair" was generated by subtracting the present worth of the replacement task, if its occurrence is 25 years or less, and any high-cost tasks from the present worth values given in the "Present Worth" section of the table. The remaining present worth figures for the low-cost task resources are divided by the cumulative 25-year present worth figure to arrive at the "uniform" or "annual" maintenance figures shown under the "Annual Maintenance and Repair" heading.

There are two types of tasks listed under the heading "Replacement and High-Cost Tasks." The first is the replacement task. The replacement task is shown on the same line as the component description. For example, the replacement task for Built-up Roofing shown in Table 3 would occur when the built-up roof is 28 years old. Replacement would require the expenditure of 0.04938 hours of labor per square foot, \$0.70490 of material per square foot, and 0.02469 hours of equipment (roofing maintenance truck) per square foot of roof area. The second type of task is the high-cost task. Each high-cost task is listed on a separate line below the component description line. For example, there is one high-cost task for built-up roofing shown in Table 3. The high-cost task "Place New Membrane Over Existing Built-up Roof" would occur when the roof is 14 years old. This would require the expenditure of 0.02414 hours of labor per square foot, \$0.69960 of material per square foot, and 0.01207 hours of equipment (roofing maintenance truck) per square foot of roof area.

Table 9

Seven Percent Discount Factors From Date of Study*

Years from BOD		End of Year	Accumulated End of Year
1		0.9346	0.9346
2		0.8734	1.8080
3		0.8163	2.6243
4		0.7629	3.3872
5		0.7130	4.1002
6		0.6663	4.7665
7		0.6227	5.3893
8		0.5820	5.9713
9		0.5439	6.5152
10		0.5083	7.0236
11		0.4751	7.4987
12		0.4440	7.9427
13		0.4150	8.3576
14		0.3878	8.7455
15		0.3624	9.1079
16		0.3387	9.4466
17		0.3166	9.7632
18		0.2959	10.0591
19		0.2765	10.3356
20		0.2584	10.5940
21		0.2415	10.8355
22		0.2257	11.0612
23		0.2109	11.2722
24		0.1971	11.4693
25	(Retention value at end of 25th year)	0.1842	11.6536

*Date of Study (DOS) is the Beneficial Occupancy Date (BOD)

Table 10

Ten Percent Discount Factors From Date of Study

Date of Study (DOS) Exactly 3 Years Before the Beneficial Occupancy Date (BOD)

	Factors		
Year from BOD	Mid-Year	End of Year	**Accumulated** Mid-Year
-3	0.9535		0.0
-2	0.8668		0.0
-1	0.7880		0.0
BOD			
1	0.7164		0.7164
2	0.6512		1.3676
3	0.5920		1.9596
4	0.5382		2.4978
5	0.4893		2.9871
6	0.4448		3.4319
7	0.4044		3.8362
8	0.3676		4.2038
9	0.3342		4.5380
10	0.3038		4.8418
11	0.2762		5.1180
12	0.2511		5.3691
13	0.2283		5.5973
14	0.2075		5.8048
15	0.1886		5.9935
16	0.1715		6.1650
17	0.1559		6.3209
18	0.1417		6.4626
19	0.1288		6.5914
20	0.1171		6.7086
21	0.1065		6.8150
22	0.0968		6.9118
23	0.0880		6.9998
24	0.0800		7.0799
25	0.0727		7.1526
Retention Value at End of 25th Year		0.0693	

For example, using the shingle roof labor hours, the total labor hours for the 25-year period shown in Table 3 is 0.02210. The replacement task would occur in year 40 and is not included in the study period. The task of placing one new layer of shingles over the existing roof occurs in year 20. The labor hours value shown in Table 3, 0.02996, is multiplied by the present worth factor for year 20 shown in Table 10, 0.1171, to obtain a present worth labor hour of 0.00351. This value is now subtracted from the total period labor hours: 0.02210 - 0.00351 = 0.01859. This figure represents the combination of all nonreplacement and high-cost tasks. Most computer programs allow the user to input one annual maintenance figure. To convert this present worth back into an equivalent annual figure, the 0.01859 is divided by the accumulated present worth value of 7.1526 shown at the bottom of Table 10 for a uniform value of 0.00259.

4 DATA BASE APPLICATION EXAMPLES

Introduction

This chapter is divided into two sections. The first section defines the terminology used in the report and information needed to apply the labor hour, material cost and equipment hour resource data in this report. The second section gives specific examples using both the 10 percent present worth tables given in Appendix B and the 7 percent present worth tables given in Appendix A.

Terminology

Economic Studies

Two basic types of economic studies are covered in this report: (1) general economic studies and (2) special energy-conservation studies.

General economic studies are conducted routinely as part of the design process for all military facilities. Such studies are normally performed for a 25-year period using a 10 percent discount rate and considering tasks to be performed mid-year. The Beneficial Occupancy Date (BOD) occurs approximately 3 years after the Date of Study (DOS) for most MILCON projects, and that is what is assumed in the example provided herein.

Special economic studies for the design of energy-consuming portions of a building are required by statute. Such studies analyze the use of extraordinary energy-saving design initiatives to conserve energy in new Federal facilities. The studies are normally performed for a 25-year period using a 7 percent discount rate considering all tasks to be performed at the end of the year. The BOD is normally assumed to occur on the DOS, in accordance with the provisions of the design criteria.

Installation Labor Rates

To perform an accurate cost analysis, the current shop effective labor rates and equipment rates per hour must be obtained from the installation. This information can be obtained from the DEH. Telephone numbers for the DEH are listed in the "Director of Engineering and Housing/Facilities, Engineer Assignments Roster" published yearly by the Office of the Chief of Engineers. Most installations maintain this information within their IFS data base; it can be obtained from the IFS data base administrator within the Management Engineering and Systems Branch.

Initial Costs

The initial construction costs can be obtained from the CACES Regional Unit Cost Manuals. The manuals are available from the district cost estimating section. When this manual is not available the cost estimates can be taken from other publications such as Means and Dodge.

Geographical Location Adjustment Factors

The Washington, DC-based material costs in the summary tables can be adjusted to a specific installation through the application of a geographical location adjustment factor. The factors are published in AR 415-17 and updates are available through the PAX computer system (Area Cost Factor Newsletter) and through the Engineering Improvement Recommendation System (EIRS) Bulletin. The 1988 set of factors is given in Appendix D.

Inflation Factors

The material costs and Washington, DC, total costs presented in Appendices A and B are in July 1988 dollars. The costs need to be adjusted to the date of study by applying an approved inflation factor obtained from the District cost estimating office.

Timing of Costs

Figure 1 shows the relationship of DOS, BOD, and the end of the study (EOS) which is assumed to be a 25-year comparison period:

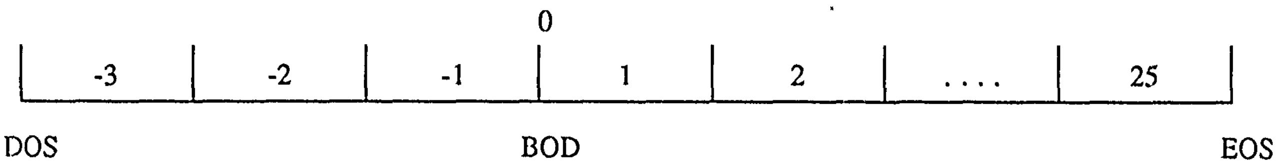

Figure 1. DOS, BOD, EOS relationship.

In Appendix B, costs are discounted 3 years from time of occurrence to DOS. M&R costs occur throughout a year and are costed at mid-year in accordance with established criteria for MILCON design. The basic present worth factor formula is:

$$PWF(BA) = \frac{1}{(1 + DR)^{(B + BA - C)}} \qquad \text{[Eq 1]}$$

where PWF = present worth factor
BA = building age
DR = discount rate
B = years from DOS to BOD
C = task placement, either 0.5 for mid-year, or 0 for end of year.

The 10 percent present worth factor to bring costs from the mid-year of first year of occupancy to the DOS is $1/(1.1)^{3.5} = 0.7164$ which is the first value in Table 10. If the DOS is not 3 years before BOD, Appendix B data can be adjusted. For example, if there is only 1 year between BOD and DOS (two less than the 3 years in the appendices), multiply this data by $(1.1)^2$. If there are 5 years (2 years more than the 3 years in the appendices), divide by $(1.1)^2$.

In Appendix A, the DOS and BOD are identical. M&R costs are assumed to occur at the end of the year as stipulated by regulations. The basic formula is:

$$PWF(BA) = \frac{1}{(1 + DR)^{(BA)}} \qquad \text{[Eq 2]}$$

where PWF = present worth factor
BA = building age
DR = discount rate

Disposal Costs/Retention Value

When disposal costs/retention value is considered, it should be expressed as a percentage of the initial cost occurring at the end of the study period. The present worth of this value can be subtracted from the final net present worth.

Examples

Introduction

This section contains one example for each of the basic uses for this life-cycle cost data. The first two examples demonstrate the procedures for calculating LCC for construction and maintenance and repair when the DOS is exactly 3 years before the BOD; the building is 25 years old at the end of the study; and installation resource costs are available from the installation. The third example demonstrates the procedures for calculating LCC for construction and maintenance and repair when data is not available from the installation and Washington, DC, cost data is to be applied. Examples 4 and 5 show how to adjust data to cover the case for which BOD is not 3 years after DOS. Example 6 shows how to use the data to generate input for other computer programs. Example 7 demonstrates the use for a project containing an extraordinary energy-saving design initiative to conserve energy.

Each example is presented in five sections:

1. Statement of the problem.

2. Identification of all installation-related information.

3. Identification of all component-related information.

4. Description of the present worth calculations.

5. A typical calculation worksheet.

Example 1: BOD 3 Years After DOS--Built-up Roof

Problem Statement. This example demonstrates all steps using a built-up roof covering with an area of 10,000 sq ft. An apartment building for family housing is under design at Fort Eustis, VA. The DOS is July 1989. The projected BOD is July 1992. A 25-year life-cycle cost analysis using a 10 percent discount rate is required.

Installation-Related Data.

Geographic Location Adjustment Factor. The geographic location adjustment factor (LAF) can be obtained from the latest EIRS bulletin or from the Area Cost Factor Newsletter on the PAX computer system, as shown in Appendix D. The factors are indexed by state and then by location within the state. From Appendix D, for Virginia and Fort Eustis, the geographic LAF (or Area Cost Factor [ACF] Index) is 0.96.

Inflation. The cost data in Appendix B is expressed in July 1988 dollars. Since the date of the study is July 1989, all cost figures must be adjusted. A telephone conversation with a District cost estimator has revealed that the costs have risen 2 percent from July 1988 to July 1989. This means that all costs need to be multiplied by a 1.02 cost adjustment factor.

Resource Rates. The labor and equipment resources in Appendix B are expressed in hours per unit measure. To obtain accurate cost figures the designer called the Fort Eustis DEH-MES branch. The July 1989 rates of $13.50/hr for a roofer and $3.00/hr for a roofing maintenance truck were obtained.

Component Information.

Size. The designer is considering a built-up roof covering with an area of 10,000 sq ft.

Initial Costs. The designer obtained a CACES unit price manual from the cost estimator. For the built-up roofing component, a cost of $0.998/sq ft was obtained. (Note. if the component is not found in the *CACES Unit Price Manual*, other books such as Means and Dodge can be used.)

Retention Value. The average life of a built-up roof is 28 years, as shown for the replacement task in Appendix B. At the end of the 25-year analysis period, the roof covering would still have 3 years of life remaining or 3/28 = 11 percent of its useful life. The salvage value can be considered to be 11 percent of the initial cost of $0.998 per square foot, or $0.1098/sq ft.

Present Worth Calculations. Three factors must be considered when performing a present worth calculation: initial cost, maintenance costs, and salvage value. Each factor is discussed below.

Initial Costs. The average construction project would normally be completed in 1 year. The contractor normally receives progress payments for work completed throughout the construction period. The initial cost of $0.998/sq ft is assumed to occur at the midpoint of construction during the year before BOD. The present worth factor at midyear for the year before BOD is given in the second column of Table 10 as 0.7880. The present worth of the initial cost would be the initial cost multiplied by the present worth factor 1 year before BOD or $0.998/sq ft x 0.7880 = $0.78642/sq ft.

25-Year Maintenance Cost. The total 25-year maintenance cost is composed of three parts: labor, material, and equipment. Labor costs per square foot are equal to the labor hours per square foot obtained from Appendix B, multiplied by the installation labor hourly rate. This would be 0.03987 hr/sq ft multiplied by a labor rate of $13.50/hr, which is equal to $0.53824/sq ft.

$$\text{Labor} = 0.03987 \text{ hours/sq ft} \times \$13.50\text{/hr} = \$0.53824\text{/sq ft} \qquad \text{[Eq 3]}$$

Material costs per square foot are equal to the material dollars in Washington, DC, base per square foot obtained from Appendix B, multiplied by the geographic LAF from Appendix D and then multiplied by the inflation factor. This would be $0.37166 DC-based dollars per square foot multiplied by a geographic LAF of 0.96 and a cost escalation factor (CEF) of 1.02 which is equal to $0.36393/sq ft.

$$\text{Material} = \$0.37166\text{/sq ft} \times 0.96 \times 1.02 = \$0.36393\text{/sq ft} \qquad \text{[Eq 4]}$$

Equipment costs per square foot are equal to the equipment hours per square foot obtained from Appendix B, multiplied by the installation equipment hourly rate. This would be 0.01994 hr/sq ft multiplied by an equipment rate of $3.00/hr which is equal to $0.05982/sq ft.

$$\text{Equipment} = 0.01994 \text{ hr/sq ft} \times \$3.00\text{/hr} = \$0.05982\text{/sq ft} \qquad \text{[Eq 5]}$$

The total maintenance cost per square foot would be the labor cost ($0.53825/sq ft) plus the material cost ($.36393/sq ft) plus the equipment cost ($0.05982/sq ft) or $0.96199/sq ft.

$$\text{Total} = \$0.53824\text{/sq ft} + \$0.36393\text{/sq ft} + \$0.05982\text{/sq ft} = \$0.96199\text{/sq ft} \qquad \text{[Eq 6]}$$

This total has already been discounted to the DOS since all figures on the left side of the table in Appendix B are expressed in terms of the DOS.

Retention Value. The DOS present worth for the retention value would be the expected retention value of $0.10980/sq ft multiplied by the end-of-year present worth factor for the end of study year (EOS) obtained from Table 10, 0.06930, which produces a cost of $0.00761/sq ft.

Total Life Cycle Cost for Construction and Maintenance and Repair. The total life-cycle cost (LCC) per square foot for the DOS is the sum of the present worth costs for the initial cost of $0.78642/sq ft plus the 25-year maintenance cost of $0.96199/sq ft minus the retention value of $0.00761/sq ft.

Total LCC = $0.78642/sq ft + $0.96199/sq ft - $0.00761/sq ft = $1.74080/sq ft [Eq 7]

The total dollar cost would be the LCC per square foot of $1.74080 multiplied by the roof area of 10,000 sq ft producing a total cost of $17,408.00.

Calculation Sheet. A typical calculation sheet is shown in Table 11.

Table 11

Calculation Sheet - Example 1

	Calculation Column	Subfactor Cost/sq ft	Factor Cost/sq ft	Total Cost
Initial Cost				
Initial Cost	$.998/sq ft			
PWF for BOD-1	x .7880			
Initial cost/sq ft			$.78642/sq ft	
25-Year Maintenance Cost				
PW - Labor	.03987hr/sq ft			
Labor Rate	x $13.50/hr			
Labor cost/sq ft		$.53824/sq ft		
PW - Material	$.37166/sq ft			
LAF	x .96			
CEF	x 1.02			
Material cost/sq ft		$.36393/sq ft		
PW - Equipment	.01994 hrs/sq ft			
Equipment Rate	x $3.00/hr			
Equipment cost/sq ft		$.05982/sq ft		
Maintenance cost/sq ft			$.96199/sq ft	
Retention Value				
Initial Cost	$.998/sq ft			
Remaining Life	x .11			
PWF for EOS	x .06930			
Retention cost/sq ft			- $.00761/sq ft	
Life Cycle Cost/sq ft			$1.74080 sq ft	
Area			x 10,000 sq ft	
TOTAL Life Cycle Cost				$17,408.00

Example 2: BOD 3 Years After DOS--Shingle Roof

Problem Statement. This example demonstrates all steps using a shingle roof covering with an area of 10,000 sq ft. An apartment building for family housing is under design at Fort Eustis, VA. The DOS is July 1989. The projected BOD is July 1992, 3 years after DOS. A 25-year LCC analysis using a 10 percent mid-year discount rate is required.

Installation Related Data.

Geographic location adjustment factor. The geographic LAF can be obtained from the latest EIRS bulletin on the PAX computer system as shown in Appendix D. The factors are indexed by state and then by location within the state. From Appendix D for Virginia and Fort Eustis, the geographic LAF (or ACF Index) is 0.96.

Inflation. The cost data in Appendix B is expressed in July 1988 dollars. Since the DOS is July 1989, all cost figures must be adjusted. A telephone conversation with a District cost estimator has revealed that the costs have risen 2 percent from July 1988 to July 1989. This means that all costs need to be multiplied by a 1.02 cost adjustment factor.

Resource Rates. The labor and equipment resources in Appendix B are expressed in hours per unit measure. To obtain accurate cost figures the designer called the Fort Eustis DEH-MES branch. The July 1989 rates for a roofer, $13.50/hr and the roofing maintenance truck, $3.00/hr, were obtained.

Component Information.

Size. The designer is considering a shingle roof covering with an area of 10,000 square feet.

Initial Costs. The designer obtained a *CACES Unit Price Manual* from the cost estimator. For the shingle roofing component, a cost figure of $0.660/sq ft was obtained. (Note. if the component is not found in the *CACES Unit Price Manual,* other books such as Means and Dodge can be used.)

Retention Value. The average life of a shingle roof is 40 years as shown for the replacement table in Appendix B. At the end of the 25-year analysis period, the roof covering would still have 15 years of life remaining or 15/40 = 37.5 percent of its useful life. The salvage value can be considered to be 37.5 percent of the initial cost of $0.660/sq ft or $0.2475/sq ft.

Present Worth Calculations Three factors need to be considered when performing a present worth calculation: initial cost, maintenance costs, and salvage value.

Each factor is discussed below.

Initial Costs. The average construction project would normally be completed in 1 year. The contractor normally receives progress payments for work completed throughout the construction period. The initial cost of $0 660/sq ft is assumed to occur at the midpoint of construction during the year before BOD. The present worth factor at midyear for the year before BOD is given in the second column of Table 10 as 0.7880. The present worth of the initial cost would be the initial cost multiplied by the present worth factor 1 year before BOD or $0.660/sq ft x 0.7880 = $0.52008/sq ft.

25-Year Maintenance Cost. The total 25-year maintenance cost is composed of three parts: labor, material, and equipment. Labor costs per square foot are equal to the labor hours per square foot obtained from Appendix B multiplied by the installation labor hourly rate. This would be 0.02222 hr/sq ft multiplied by a labor rate of $13.50/hr which is equal to $0.29997/sq ft.

Labor = 0.02222 hr/sq ft x $13.50/hr = $0.29997/sq ft [Eq 8]

Material costs per square foot are equal to the material dollars in Washington, DC, base per square foot obtained from Appendix B, multiplied by the geographic LAF from Appendix D and then multiplied by the inflation factor. This would be $0.22132 DC-based dollars per square foot multiplied by a geographic LAF of 0.96 and a CEF of 1.02 which is equal to $0.21672/sq ft.

Material = $0.22132/sq ft x 0.96 x 1.02 = $0.21672/sq ft [Eq 9]

Equipment costs per square foot are equal to the equipment hours per square foot obtained from Appendix B, multiplied by the installation equipment hourly rate. This would be 0.01112 hr/sq ft multiplied by an equipment rate of $3.00/hr which is equal to $0.03333/sq ft.

Equipment = 0.01111 hr/sq ft x $3.00/hr = $0.03333/sq ft [Eq 10]

The total maintenance cost per square foot would be the labor cost ($0.29997/sq ft) plus the material cost ($0.21672/sq ft) plus the equipment cost ($0.03333/sq ft), or $0.55002/sq ft.

Total = $0.29997/sq ft + $0.21672/sq ft + $0.03333/sq ft = $0.55002/sq ft [Eq 11]

This total has already been discounted to the DOS since all figures on the left side of the table in Appendix B are expressed in terms of the DOS.

Retention Value. The DOS present worth for the retention value would be the expected retention value, $0.2475/sq ft, multiplied by the end of year present worth factor for the EOD obtained from Table 10, 0.06930, which produces a cost of $0.01715/sq ft.

Total Life Cycle Cost for Construction and Maintenance and Repair. The total LCC per square foot for the DOS is the sum of the present worth costs for the initial cost of $0.52008/sq ft plus the 25-year maintenance cost of $0.55002/sq ft minus the retention value of $0.01715/sq ft.

Total LCC = $0.52008/sq ft + $0.55002/sq ft - $0.01715/sq ft = $1.05295/sq ft [Eq 12]

The total dollar cost would be the LCC per square foot, $1.05295, multiplied by the roof area, 10,000 sq ft, producing a total cost of $10,529.50.

Calculation Sheet. A typical calculation sheet is shown in Table 12.

Example 3: BOD 3 Years After DOS -- Washington, DC Rate Applied

Problem Statement This example demonstrates all steps using a built-up roof covering with an area of 10,000 sq ft. An apartment building for family housing is under design at Fort Eustis, VA. The DOS is July 1989. The projected BOD is July 1992, three years after DOS. A 25-year life-cycle cost analysis using a 10 percent mid-year discount rate is required.

Table 12

Calculation Sheet - Example 2

	Calculation Column	Subfactor Cost/sq ft	Factor Cost/sq ft	Total Cost
Initial Cost				
Initial Costs	$.660/sq ft			
PWF for BOD-1	x .7880			
Initial Costs/sq ft			$.52008/sq ft	
25-Year Maintenance Cost				
PW - Labor	.02222 hr/sq ft			
Labor Rate	x $13.50/hr			
Labor cost/sq ft		$.29997/sq ft		
PW - Material	$.22132/sq ft			
LAF	x .96			
CEF	x 1.02			
Material cost/sq ft		$.21672/sq ft		
PW - Equipment	.01111 hr/sq ft			
Equipment Rate	x $3.00/hr			
Equipment cost/sq ft		$.03333/sq ft		
Maintenance Cost/sq ft			$.55002/sq ft	
Retention Value				
Initial Cost		$.660/sq ft		
Remaining Life		x .375		
PWF for EOS		x .06930		
Retention value/sq ft			- $.01715/sq ft	
Life Cycle Cost/sq ft			$1.05295/sq ft	
Area		x 10,000 sq ft		
TOTAL Life Cycle Cost				$10,529.50

The designer wishes to perform a rough cost estimate without calling the installation to obtain cost information. It should be understood that the installation's costs may vary significantly from the Washington, DC, costs and the rough calculations may be misleading. However, if the designer is going to compare several types of components such as built-up, slate, and shingle roofs--all of which involve the identical trade such as a roofer--the comparisons may be quite accurate.

Installation-Related Data.

Geographic Location Adjustment Factor. The geographic LAF can be obtained from the latest EIRS bulletin or from the Area Cost Factor Newsletter on the PAX computer system as shown in Appendix D. The factors are indexed by state and then by location within the state. From Appendix D, for Virginia and Fort Eustis, the geographic LAF (or ACF Index) is 0.96.

Inflation. The cost data in Appendix B is expressed in July 1988 dollars. Since the DOS is July 1989, all cost figures must be adjusted. A telephone conversation with a District cost estimator has revealed that the costs have risen 2 percent from July 1988 to July 1989. This means that all costs need to be multiplied by a 1.02 cost adjustment factor.

Resource Rates. The designer wishes to perform a rough calculation using the Washington, DC, labor and equipment rates rather than calling the installation.

<u>Component Information.</u>

Size. The designer is considering a built-up roof covering with an area of 10,000 sq ft.

Initial Costs. The designer obtained a *CACES Unit Price Manual* from the cost estimator. For the built-up roofing component, a cost figure of $0.998/sq ft was obtained. (Note: if the component is not found in the *CACES Unit Price Manual*, other books such as Means and Dodge can be used.)

Retention Value. The average life of a built-up roof is 28 years, as shown for the replacement task in Appendix B. At the end of the 25-year analysis period, the roof covering would still have 3 years of life remaining or 3/28 = 11 percent of its useful life. The salvage value can be considered to be 11 percent of the initial cost of $0.998/sq ft or $0.10980/sq ft.

<u>Present Worth Calculations</u>. Three factors need to be considered when performing a present worth calculation: initial cost, maintenance costs, and salvage value. Each factor is discussed below.

Initial Costs. The average construction project would normally be completed in 1 year. The contractor normally receives progress payments for work completed throughout the construction period. The initial cost of $0.998/sq ft is assumed to occur at the midpoint of construction during the year before BOD. The present worth factor at midyear for the year before BOD is given in the second column of Table 10 as 0.7880. The present worth of the initial cost would be the initial cost multiplied by the present worth factor 1 year before BOD or $0.998/sq ft x 0.7880 = $0.78642/sq ft.

25-Year Maintenance Cost. The total 25-year maintenance cost for Fort Eustis can be calculated by taking the Washington, DC, total cost per square foot, $1.25, and multiplying by the location adjustment factor (0.96) producing a cost of $1.20/sq ft.

Retention Value. The DOS present worth for the retention value would be the expected retention value of $0.10980/sq ft multiplied by the end of year present worth factor for the EOD obtained from Table 10, 0.06930, which produces a cost of $0.00761/sq ft.

Total LCC for Construction and Maintenance and Repair. The total LCC per square foot for the DOS is the sum of the present worth costs for the initial cost of $0.78642/sq ft plus the 25-year maintenance cost of $1.20/sq ft minus the retention value of $0.00761/sq ft.

$$\text{Total LCC} = \$0.78642/\text{sq ft} + \$1.20/\text{sq ft} - \$0.00761/\text{sq ft} = \$1.97881/\text{sq ft} \qquad \text{[Eq 13]}$$

The total dollar cost would be the LCC per square foot, $1.97881, multiplied by the roof area, 10,000 sq ft, producing a total cost of $19,788.10

<u>Calculation Sheet</u>. A typical calculation sheet is shown in Table 13.

Table 13

Calculation Sheet - Example 3

	Calculation Column	Subfactor Cost/sq ft	Factor Cost/sq ft	Total Cost
Initial Cost				
Initial Cost	$.998/sq ft			
PWF for BOD	x .7880			
Initial Cost/sq ft			$.78642/sq ft	
25-Year Maintenance Cost				
PW Total	$1.25/sq ft			
LAF	x .96			
Maintenance Cost/sq ft			$1.20/sq ft	
Retention Value				
Initial Cost	$.988/sq ft			
Remaining Life	x .11			
PWF for EOS	x .06930			
Retention value/sq ft			- $.00761/sq ft	
Life Cycle cost/sq ft			$1.97881/sq ft	
Area		x 10,000 sq ft		
TOTAL Life Cycle Cost				$19,788.10

Example 4: DOS Less Than 3 Years Before BOD

Perform the calculations as shown in Examples 1 through 3. The answers are lower than the actual DOS answers. The calculated values must be adjusted by multiplying by the formula:

$$(1 + DR)^{(3-A)} \quad \text{[Eq 14]}$$

where DR = discount rate
3 = years between DOS and BOD given in the tables
A = actual years between DOS and BOD.

For example, using the answer of $17,408.00 in Example 1 and assuming 1 year between BOD and DOS with discount rate = 10% (0.10), the formula would be $(1.10)^{(3-1)} = (1.1)^{(2)} = 1.21$. The correct answer would be $17,408.00 x 1.21 = $21,063.68

Example 5: DOS Greater Than 3 Years Before BOD

Perform the calculation as shown in Examples 1 through 3. The answers are larger than the actual DOS answers. The calculated values must be adjusted by dividing by the formula:

$$(1 + DR)^{(A-3)} \quad \text{[Eq 15]}$$

where DR = discount rate

3 = years between DOS and BOD given in the tables

A = actual years between DOS and BOD

For example, using the answer of $17,408.00 in Example 1 and assuming 5 years between BOD and DOS with d = 10 percent (0.10), the formula would be $(1.10)^{(5-3)} = (1.10)^{(2)} = 1.21$. The correct answer would be $17,408.00 + 1.21 = $14,686.78

Example 6: Computer Input--BOD 3 Years After DOS (Built-up Roof)

Problem Statement. This example demonstrates all steps using a built-up roof covering with an area of 10,000 sq ft. An apartment building for family housing is under design at Fort Eustis, VA. The BOD is July 1992. The DOS is 3 years before BOD or July 1989. A 25-year LCC analysis using a 10 percent discount rate is required. A computer program, such as the Corps' LCCID, that requires an annual maintenance figure and high cost tasks will be used.

Installation Related Data.

Geographic Location Adjustment Factor. The LAF can be obtained from the latest EIRS bulletin or from the Area Cost Factor Newsletter on the PAX computer system as shown in Appendix D. The factors are indexed by state and then by location within the state. From Appendix D, for Virginia and Fort Eustis, the geographic LAF (or ACF Index) is 0.96.

Inflation. The cost data in Appendix B is expressed in July 1988 dollars. Since the DOS is July 1989, all cost figures must be adjusted. A telephone conversation with a District cost estimator has revealed that the costs have risen 2 percent from July 1988 to July 1989. This means that all costs need to be multiplied by a 1.02 cost adjustment factor.

Resource Rates. The labor and equipment resources in Appendix B are expressed in hours per unit measure. To obtain accurate cost figures the designer called the Fort Eustis DEH-MES branch. The July 1989 rates of $13.50/hr for a roofer and $3.00/hr for a roofing maintenance truck were obtained.

Component Information.

Size. The designer is considering a built-up roof covering with an area of 10,000 sq ft.

Initial Costs. The designer obtained a *CACES Unit Price Manual* from the cost estimator. By looking up the built-up roofing component, a cost of $0.998/sq ft was obtained. (Note: if the component is not found in the *CACES Unit Price Manual*, other books such as Means and Dodge can be used.)

Retention Value. The average life of a built-up roof is 28 years, as shown for the replacement table in Appendix B. At the end of the 25-year analysis period, the roof covering would still have 3 years of life remaining or 3/28 = 11 percent of its useful life. The salvage value can be considered to be 11 percent of the initial cost of $0.998/sq ft, or $0.1098/sq ft.

Data Entry Calculations Four factors need to be considered when performing a present worth calculation: initial cost, annual maintenance costs, high costs, and salvage value. Each factor is discussed below.

Initial Costs. The initial cost of \$0.998/sq ft is estimated from CACES as discussed above.

25-Year Maintenance Cost. The total annual 25-year maintenance cost is composed of three parts: labor, material, and equipment. Annual labor costs per square feet are equal to the labor hours per square foot obtained from Appendix B, multiplied by the installation labor hourly rate. This would be 0.00488 hr/sq ft/yr multiplied by a labor rate of \$13.50/hr, which is equal to \$0.06575/sq ft/yr.

$$\text{Labor} = 0.00487 \text{ hr/sq ft/yr} \times \$13.50\text{/hr} = \$0.06575\text{/sq ft/yr} \quad \text{[Eq 16]}$$

Annual material costs per square foot are equal to the material dollars in Washington, DC, base per square foot obtained from Appendix B, multiplied by the geographic LAF from Appendix D, and then multiplied by the inflation factor. This would be \$0.03171 DC-based dollars per square foot per year multiplied by a geographic LAF of 0.96 and a CEF of 1.02, or \$0.03105/sq ft/yr.

$$\text{Material} = \$0.03171\text{/sq ft/yr} \times 0.96 \times 1.02 = \$0.03105\text{/sq ft/yr} \quad \text{[Eq 17]}$$

Annual equipment costs per square foot are equal to the equipment hours per square foot obtained from Appendix B, multiplied by the installation equipment hourly rate. This would be 0.00244 hr/sq ft/yr multiplied by an equipment rate of \$3.00/hr, which is equal to \$0.00732/sq ft/yr.

$$\text{Equipment} = 0.00244 \text{ hr/sq ft/yr} \times \$3.00\text{/hr} = \$0.00732\text{/sq ft/yr} \quad \text{[Eq 18]}$$

The total annual maintenance cost per square foot would be the labor cost (\$0.06575/sq ft/yr) plus the material cost (\$0.03105/sq ft/yr), plus the equipment cost (\$0.00732/sq ft/yr) or \$.104222/sq ft/yr.

$$\text{Total: } \$0.06575\text{/sq ft/yr} + \$0.03105\text{/sq ft/yr} + \$0.00732\text{/sq ft/yr} = \$0.10412\text{/sq ft/yr} \quad \text{[Eq 19]}$$

The total cost figure for the uniform maintenance cost for computer entry is obtained by multiplying the total of \$0.10409 by the square footage of 10,000 sq ft, resulting in an annual cost of \$10,409.00.

High Cost. There is one high-cost task for built-up roofing. This task occurs in the 14th year. The resources required to perform this task are given below.

The labor resources are obtained by multiplying the labor hours per square foot, 0.02414, by the labor rate, \$13.50/hr, resulting in \$0.32589/sq ft.

$$\text{Labor} = 0.02414 \text{ hr/sq ft} \times \$13.50\text{/hr} = \$0.32589\text{/sq ft} \quad \text{[Eq 20]}$$

The material resources are obtained by multiplying the material cost in DC base, \$0.69960/sq ft, by the cost escalation factor, 1.02, and the location adjustment factor, 0.96, resulting in \$0.68505/sq ft.

$$\text{Material} = \$0.69960\text{/sq ft} \times 1.02 \times 0.96 = \$0.68505\text{/sq ft} \quad \text{[Eq 21]}$$

Equipment resources are obtained by multiplying the equipment resources of 0.01207 hr/sq ft by the equipment rate of \$3.00/hr resulting in \$0.03621/sq ft.

$$\text{Equipment} = 0.01207 \text{ hr/sq ft} \times \$3.00\text{/hr} = \$0.03621\text{/sq ft} \quad \text{[Eq 22]}$$

Total cost for this one task would be the sum of the labor, material, and equipment costs.

$$\text{Total} = \$0.32589/\text{sq ft} + \$0.68505/\text{sq ft} + \$0.03621/\text{sq ft} = \$1.04715/\text{sq ft} \quad \text{[Eq 23]}$$

The total cost figure for computer entry is obtained by multiplying the total of $1.04715/sq ft by the square footage of 10,000 for a cost of $10,471.50 occurring in year 14.

Retention Value. The expected retention value is calculated as follows: at the end of the 25-year analysis period, the roof covering would still have 3 years of life remaining or 3/28 = 11 percent of its useful life. The value is then 11 percent of the initial cost of $0.998/sq ft or $0.10978/sq ft.

The calculated values are entered into the computer and the computer performs the appropriate discounting.

Calculation Sheet: A typical calculation sheet is shown in Table 14.

Example 7: Extraordinary Energy-Saving Design Initiatives--Built-up Roof

Problem Statement. This example demonstrates all steps involved in using the summary tables in Appendix A for the conventional built-up roof covering alternative. An apartment building for family housing is under design at Fort Eustis, VA. The designers are considering the use of a new-technology energy conserving, low maintenance roof, in place of a conventional built-up roof, and will determine which is more cost effective on the basis of a life-cycle cost analysis. The roof area is 10,000 square feet. The DOS is July 1989. The analysis period is 25 years. In accordance with established criteria for energy-conservation studies, the BOD is assumed to occur on the DOS (July 1989); all costs are assumed occur at the end of the year in which they are projected occur; and the discount rate for the present worth calculations is assumed to be 7 percent.

Installation Related Data.

Geographic Location Adjustment Factor. The geographic LAF can be obtained from the latest EIRS bulletin or from the Area Cost Factor Newsletter on the PAX computer system as shown in Appendix D. The factors are indexed by state and then by location within the state. From Appendix D, for Virginia and Fort Eustis, the geographic LAF (or ACF Index) is 0.96.

Inflation. The cost data in Appendix A is expressed in July 1988 dollars. Since the DOS is July 1989, all cost figures must be adjusted. A telephone conversation with a District cost estimator has revealed that the costs have risen 2 percent from July 1988 to July 1989. This means that all costs need to be multiplied by a 1.02 cost adjustment factor.

Table 14

Calculation Sheet - Example 6

ANNUAL MAINTENANCE

	Calculation Column	Subfactor Cost/sq ft	Factor Cost/sq ft	Total Cost
Initial Cost				
Initial Cost/sq ft	$.998/sq ft			
Area	x 10,000 sq ft			
Initial Cost			$9,980	
25-Year Annual Maintenance				
Labor hours/sq ft	.00488 hr/sq ft			
Labor Rate	x $13.50/hr			
Labor cost/sq ft		$.06575/sq ft		
Material/sq ft	$.03171/sq ft			
AF	x .96			
CEF	x 1.02			
Material cost/sq ft		.031021		
Equipment	.00244 hr/sq ft			
Equipment Rate	x $3.00/hr			
Equipment cost/sq ft		$.00732/sq ft		
Annual Maintenance/sq ft		$.10412/sq ft		
Square Feet		x10,000 sq ft		
TOTAL Annual Maintenance			$10,412.00	
HIGH COST TASK				
Labor	.02414 hr/sq ft			
Labor Rate	x $13.50/hr			
Labor cost/sq ft		$.32589/sq ft		
Material	$.069960/sq ft			
LAF	x .96			
CEF	x 1.02			
Materials cost/sq ft		$.68505/sq ft		
Equipment	.01207 hr/sq ft			
Equipment Rate	$3.00/hr			
Equipment/sq ft		$.03621/sq ft		
Maintenance cost/sq ft			$1.04715/sq ft	
Square Feet		x 10,000 sq ft		
TOTAL Maintenance Cost for High Cost Task			$10,471.50	
Retention Value				
Initial Cost	$.988/sq ft			
Remaining Life	x .11			
Total/sq ft		$.10978/sq ft		
Square Feet		x 10,000 sq ft		
Retention Value			$1,097.80	

Resource Rates: The labor and equipment resources in Appendix B are expressed in hours per unit measure. To obtain accurate cost figures, the designer called the Fort Eustis DEH-MES branch. The July 1989 rates of $13.50/hr for a roofer and $3.00/hr for a roofing maintenance truck were obtained.

Component Information.

Size. The designer is considering a built-up roof covering with an area of 10,000 sq ft.

Initial Costs. The designer obtained a *CACES Unit Price Manual* from the cost estimator. For the built-up roofing component a cost figure of $0.998/sq ft was obtained. (Note: if the component is not found in the *CACES Unit Price Manual*, other books such as Means and Dodge can be used.)

Retention Value. The average life of a built-up roof is 28 years as shown for the replacement task in Appendix B. At the end of the 25-year analysis period, the roof covering would still have 3 years of life remaining or 3/28 = 11 percent of its useful life. The retention value can be considered to be 11 percent of the initial cost of $0.998/sq ft or $0.10978/sq ft.

Present Worth Calculations. The following factors are considered in performing the present worth calculation: initial cost, maintenance costs, and salvage value. Each factor is discussed below.

Initial Costs. The initial cost of $0.998/sq ft is assumed to occur on the BOD/DOS in accordance with established criteria for energy conservation studies.

25-Year Maintenance Cost. The total 25-year maintenance cost is composed of three parts: labor, material, and equipment. Labor costs per square foot are equal to the labor hours per square foot obtained from Appendix A multiplied by the installation labor hourly rate. This would be 0.06653 hr/sq ft multiplied by a labor rate of $13.50/hr which is equal to $0.89816/sq ft.

$$\text{Labor} = 0.06653 \text{ hours/sq ft} \times \$13.50\text{/hour} = \$0.89816\text{/sq ft} \qquad \text{[Eq 24]}$$

Material costs per square foot are equal to the material dollars in Washington, DC, base per square foot obtained from Appendix A multiplied by the geographic LAF from Appendix D and then multiplied by the inflation factor. This would be $0.64214 DC-based dollars per square foot multiplied by a geographic LAF of 0.96 and a CEF of 1.02, which is equal to $0.62878/sq ft.

$$\text{Material} = \$0.64214\text{/sq ft} \times 0.96 \times 1.02 = \$0.62878\text{/sq ft} \qquad \text{[Eq 25]}$$

Equipment costs per square foot are equal to the equipment hours per square foot obtained from Appendix A multiplied by the installation equipment hourly rate. This would be 0.03327 hr/sq ft multiplied by an equipment rate of $3.00/hr, which is equal to $0.09981/sq ft.

$$\text{Equipment} = 0.03327 \text{ hr/sq ft} \times \$3.00\text{/hr} = \$0.09981\text{/sq ft} \qquad \text{[Eq 26]}$$

The total maintenance cost per square foot would be the labor cost ($0.89816/sq ft) plus the material cost ($0.62878/sq ft) plus the equipment cost ($0.09981/sq ft), or $1.62675/sq ft.

$$\text{Total} = \$0.89816\text{/sq ft} + \$0.62878\text{/sq ft} + \$0.09981\text{/sq ft} = \$1.62675\text{/sq ft} \qquad \text{[Eq 27]}$$

This total has already been discounted to the date of study since all figures on the left side of the table in the Appendix are expressed in terms of the DOS.

Retention Value. The DOS present worth for the retention value would be the expected retention value of \$0.10978/sq ft multiplied by the end of year present worth factor for the EOD of 0.1842 obtained from Table 9 which produces a cost of \$0.02022/sq ft.

Total Life Cycle Cost for Construction and Maintenance and Repair. The total LCC per square foot for the DOS is the sum of the present worth costs for the initial cost of \$0.998/sq ft plus the 25-year maintenance cost of \$1.62675/sq ft minus the salvage value of \$0.02022/sq ft.

Total LCC = \$0.998/sq ft + \$1.62675/sq ft - \$0.02022/sq ft = \$2.60451/sq ft [Eq 28]

The total dollar cost would be the LCC per square foot of \$2.60451 multiplied by the roof area of 10,000 sq ft producing a total cost of \$26,045.10.

Calculation Sheet. A typical calculation sheet is shown in Table 15.

Table 15

Calculation Sheet - Example 7

	Calculation Column	Subfactor Cost/sq ft	Factor Cost/sq ft	Total Cost
Initial Cost				
Initial Cost			\$.998/sq ft	
25 Year Maintenance Cost				
PW - Labor	.06653 hr/sq ft			
Labor Rate	x \$13.50/hr			
Labor cost/sq ft		\$.89816/sq ft		
PW - Material	\$.64214/sq ft			
LAF	x .96			
CEF	x 1.02			
Material cost/sq ft		\$.62878/sq ft		
PW - Equipment	.03327 hr/sq ft			
Equipment Rate	x \$3.00/hr			
Equipment cost/sq ft	\$.09981/sq ft			
Maintenance cost/sq ft			\$1.62675/sq ft	
Retention Value				
Initial Cost	\$.998/sq ft			
Remaining Life	x .11			
PWF for EOS	x .1842			
Retention value/sq ft		- \$.02022/sq ft		
Life Cycle Cost/sq ft			\$2.60451/sq ft	
Area	x 10,000 sq ft			
TOTAL Life Cycle Cost				\$26,045.10

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LIST OF ACRONYMS

ACE	Assistant Chief of Engineers
AMS	Army Management System
APC	Account Processing Code
AR	Army Regulation
ARR	Annual Requirements Report
ASTM	American Society for Testing and Materials
BLAST	Building Loads Analysis and System Thermodynamics
BMAR	Backlog of Maintenance and Repair
BOD	Beneficial Occupancy Date
CA	Commercial Activities
CACES	Computer-Assisted Cost Estimating System
CONUS	Continental United States
DA	Department of the Army
DEH	Directorate of Engineering and Housing
DOD	Department of Defense
DOS	Date of Study
EA	Economic Analysis
EC	Engineering Construction
EIRS	Engineering Improvement Recommendation System
EOS	End of Study
EPS	Engineered Performance Standards
HQ-IFS	Headquarters - Integrated Facilities
HQDA	Headquarters Department of the Army
HVAC	Heating, Ventilation, and Air-Conditioning
IFS	Integrated Facilities System

IJO	Individual Job Order
LCC	Life-Cycle Cost
LCCID	Life-Cycle Cost in Design
M&R	Maintenance and Repair
MACOM	Major Command
MCA	Military Construction, Army
MRPM	Maintenance Resource Prediction Model
OCE	Office of the Chief of Engineers
PAVER	Pavement Maintenance Management System
PAX	Programming, Administration, and Execution System
PC	Personal Computer
PM	Preventive Maintenance
R&D	Research and Development
RAM	Random Access Memory
RMF	Recurring Maintenance Factor
RPI	Real Property Inventory
RPLANS	Real Property Planning System
RPMS	Real Property Management System
SO	Service Order
STANFINS	Standard Army Financial System
TB	Technical Bulletin
URR	Unconstrained Requirements Report
USACE	U.S. Army Corps of Engineers
USACERL	U.S. Army Construction Engineering Research Laboratory
USAEHSC	U.S. Army Engineering and Housing Support Center

APPENDIX A:

LIFE-CYCLE COST ANALYSIS TABLE (7 PERCENT)

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)														PAGE 1
COMPONENT DESCRIPTION		PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%)				ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS								
		By Resources			Washington	Annual Maintenance and Repair			Replacement and High Costs Tasks					
	um	labor	material	equipment	D.C. Total	labor	material	equipment	yr	labor	material	equipment		
ARCHITECTURE														
ROOFING														
ROOF COVERING														
BUILTUP ROOFING	SF	0.06653	0.64214	0.03327	2.11	0.00491	0.03182	0.00245	28	0.04938	0.70490	0.02469		
PLACE NEW MEMBRANE OVER EXISTING -BUILTUP									14	0.02414	0.69960	0.01207		
MOD.BIT./THERMOPLASTIC	SF	0.04306	0.59712	0.02154	1.55	0.00244	0.03220	0.00122	20	0.05659	0.85860	0.02829		
THERMOSETTING	SF	0.02962	0.43960	0.01481	1.09	0.00173	0.02221	0.00086	20	0.03683	0.69960	0.01841		
SLATE	SF	0.02968	0.17286	0.01484	0.83	0.00255	0.01483	0.00127	70	0.06885	6.04200	0.03442		
CEMENT ASBESTOS	SF	0.02887	0.40355	0.01445	1.04	0.00248	0.03463	0.00124	70	0.05437	0.75190	0.02718		
TILE	SF	0.02506	0.39470	0.01252	0.95	0.00215	0.03387	0.00107	70	0.10169	3.07400	0.05084		
ROLL ROOFING	SF	0.11936	0.75476	0.05969	3.39	0.00752	0.01545	0.00376	10	0.04141	0.74963	0.0207[illegible]		
SHINGLES	SF	0.03835	0.39125	0.01918	1.24	0.00263	0.02394	0.00131	40	0.04118	0.74497	0.02059		
REPLACE NEW OVER EXISTING - SHINGLED ROOF									20	0.02996	0.43460	0.01498		
METAL	SF	0.02383	0.18471	0.01192	0.71	0.00204	0.01585	0.00102	30	0.36265	2.17300	0.18132		
FIBERGLASS RIGID STP. ROOF	SF	0.03826	2.28032	0.01913	3.12	0.00228	0.06229	0.00114	20	0.04543	6.01550	0.02272		
CONCRETE,SEALED PANEL ROOF	SF	0.07120	0.21283	0.03561	1.78	0.00611	0.01826	0.00306	60	0.06123	24.07419	0.03061		
CONCRETE,SEALED PANEL RF4	SF	0.06598	0.13913	0.03298	1.59	0.00566	0.01194	0.00283	300	0.04342	24.07419	0.02[illegible]71		
CONCRETE SEALED POURED	SF	0.16247	1.02850	0.08123	4.61	0.01394	0.08826	0.00697	500	3.81056	18.03219	1.90528		
FIBERGLASS, RIGID ROOF	SF	0.06495	2.28032	0.03247	3.71	0.00466	0.06229	0.00233	20	0.04133	6.01550	0.02066		

See NOTES on the last page of this table for Explanation of Column Headings

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)												PAGE 2
COMPONENT DESCRIPTION		PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%)				ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS						
		By Resources			Washington	Annual Maintenance and Repair			Replacement and High Costs Tasks			
	um	labor	material	equipment	D.C. Total	labor	material	equipment	yr	labor	material	equipment
ARCHITECTURE												
EXTERIOR WALL												
EXTERIOR FINISHES												
ADOBE First Floor	SF	0.06274	0.69318	0.06274	2.18	0.00538	0.05948	0.00538	300	1.10968	2.18360	0.5[illegible]62
ADOBE Second Floor	SF	0.13127	0.69318	0.13127	3.80	0.01126	0.05948	0.01126	300	1.24670	2.18360	0.63954
ADOBE Third Floor	SF	0.18112	0.69318	0.18112	4.98	0.01554	0.05948	0.01554	300	1.38333	2.18360	0.71513
CLAY BRICK First Floor	SF	0.00445	0.00449	0.00445	0.11	0.00038	0.00039	0.00038	500	1.09213	1.21900	0.54607
CLAY BRICK Second Floor	SF	0.00759	0.00449	0.00759	0.18	0.00065	0.00039	0.00065	500	1.21433	1.21900	0.60717
CLAY BRICK Third Floor	SF	0.00939	0.00449	0.00939	0.23	0.00081	0.00039	0.00081	500	1.33640	1.21900	0.66820
CLAY BRICK (WP/P) 1st Flr.	SF	0.03723	0.07590	0.03723	0.96	0.00048	0.00041	0.00048	500	1.12866	1.30380	0.58260
REFINISH PAINTED CLAY BRICK EXT. WALL - 1S									8	0.02825	0.06360	0.02825
CLAY BRICK (WP/P) 2nd Flr.	SF	0.06026	0.07590	0.06026	1.50	0.00093	0.00041	0.00093	500	1.26750	1.30380	0.66034
REFINISH PAINTED CLAY BRICK EXT.WALL - 2ND									8	0.04417	0.06360	0.04417
CLAY BRICK (WP/P) 3rd Flr.	SF	0.08102	0.07590	0.08102	1.99	0.00123	0.00041	0.00123	500	1.40608	1.30380	0.73788
REFINISH PAINTED CLAY BRICK EXT.WALL - 3RD									8	0.05969	0.06360	0.05969
CONCRETE BRICK 1st Floor	SF	0.00445	0.00543	0.00445	0.11	0.00038	0.00047	0.00038	500	1.09213	1.47340	0.54607
CONCRETE BRICK 2nd Floor	SF	0.00759	0.00543	0.00759	0.19	0.00065	0.00047	0.00065	500	1.21420	1.47340	0.60710
CONCRETE BRICK 3rd Floor	SF	0.00946	0.00543	0.00946	0.23	0.00081	0.00047	0.00081	500	1.33640	1.47340	0.66820
CONCRETE BRICK (WP/P) 1 Fl	SF	0.03663	0.07683	0.03663	0.94	0.00043	0.00049	0.00043	500	1.12866	1.55820	0.58260
REFINISH EXTERIOR WALL - 1ST FLOOR									8	0.02825	0.06360	0.02825
CONCRETE BRICK (WP/P) 2 Fl	SF	0.06029	0.07683	0.06029	1.50	0.00094	0.00049	0.00094	500	1.26750	1.55820	0.66034
REFINISH PAINTED CONCRETE BRICK EXT.WALL-2									8	0.04417	0.06360	0.04417
CONCRETE BRICK (WP/P) 3 Fl	SF	0.08102	0.07683	0.08102	1.99	0.00123	0.00049	0.00123	500	1.40608	1.55820	0.73788
REFIN.PAINTED CONC.BRICK EXT.WALL - 3RD FL									8	0.05969	0.06360	0.05969
STRUCTURAL CLAY TILE 1 Flr	SF	0.00120	0.03538	0.00120	0.06	0.00010	0.00304	0.00010	500	0.20150	9.60360	0.10075
STRUCTURAL CLAY TILE 2 Flr	SF	0.00395	0.03538	0.00395	0.13	0.00034	0.00304	0.00034	500	0.23465	9.60360	0.11733
STRUCTURAL CLAY TILE 3 Flr	SF	0.00553	0.03538	0.00553	0.17	0.00047	0.00304	0.00047	500	0.26767	9.60360	0.13384
STRUC. CLAY TILE WP/P 1 Fl	SF	0.03332	0.10678	0.03332	0.90	0.00015	0.00306	0.00015	500	0.23803	9.68840	0.13728
REFINISH PAINTED STRUCT.CLAY TILE EXT.WALL									8	0.02825	0.06360	0.02825
STRUC. CLAY TILE WP/P 2 Fl	SF	0.05662	0.10678	0.05662	1.45	0.00062	0.00306	0.00062	500	0.28782	9.68840	0.17050
REFINISH PAINTED STRUCT.CLAY TILE EXT.WALL									8	0.04417	0.06360	0.04417
STRUC. CLAY TILE WP/P 3 Fl	SF	0.07709	0.10678	0.07709	1.93	0.00089	0.00306	0.00089	500	0.33735	9.68840	0.20352
REFINISH PAINTED STRUCT.CLAY TILE EXT.WALL									8	0.05969	0.06360	0.05969
CONCRETE BLOCK First Floor	SF	0.00117	0.00311	0.00117	0.03	0.00010	0.00027	0.00010	500	0.20150	0.84376	0.10075
CONCRETE BLOCK Second Flr.	SF	0.00395	0.00311	0.00395	0.10	0.00034	0.00027	0.00034	500	0.23465	0.84376	0.11733
CONCRETE BLOCK Third Floor	SF	0.00553	0.00311	0.00553	0.13	0.00047	0.00027	0.00047	500	0.26767	0.84376	0.13384
CONCRETE BLOCK (WP/P) 1 Fl	SF	0.03335	0.07451	0.03335	0.86	0.00015	0.00029	0.00015	500	0.23803	0.92856	0.13728
REFINISH PAINTED CONCRETE BLOCK EXT.WALL -									8	0.02825	0.06360	0.02825
CONCRETE BLOCK (WP/P) 2 Fl	SF	0.05662	0.07451	0.05662	1.41	0.00062	0.00029	0.00062	500	0.28782	0.92856	0.17050
REFINISH PAINTED CONCRETE BLOCK EXT.WALL -									8	0.04417	0.06360	0.04417
CONCRETE BLOCK (WP/P) 3 Fl	SF	0.07709	0.07451	0.07709	1.90	0.00089	0.00029	0.00089	500	0.33735	0.92856	0.20352
REFINISH PAINTED CONCRETE BLOCK EXT.WALLS-									8	0.05969	0.06360	0.05969
CONCRETE (WP/P) First Flr.	SF	0.04077	0.07607	0.04077	1.04	0.00079	0.00043	0.00079	500	3.84605	4.71700	1.94129
REFINISH CONCRETE EXTERIOR WALL - 1ST FLOO									8	0.02825	0.06360	0.02825
CONCRETE (WP/P) Second Flr	SF	0.06479	0.07607	0.06479	1.61	0.00132	0.00043	0.00132	500	4.25568	4.71700	2.15443
REFINISH CONCRETE EXTERIOR WALL - 2ND FLOO									8	0.04417	0.06360	0.04417
CONCRETE (WP/P) Third Flr.	SF	0.08598	0.07607	0.08598	2.11	0.00165	0.00043	0.00165	500	4.66570	4.71700	2.36769
REFINISH CONCRETE EXTERIOR WALL - 3RD FLOO									8	0.05969	0.06360	0.05969
STONE First Floor	SF	0.00117	0.00664	0.00117	0.03	0.00010	0.00057	0.00010	500	0.20150	1.80200	0.10075
STONE Second Floor	SF	0.00395	0.00664	0.00395	0.10	0.00034	0.00057	0.00034	500	0.23465	1.80200	0.11733
STONE Third Floor	SF	0.00553	0.00664	0.00553	0.14	0.00047	0.00057	0.00047	500	0.26767	1.80200	0.13384
STUCCO First Floor	SF	0.03463	0.08680	0.03463	0.91	0.00026	0.00033	0.00026	300	0.27846	0.96460	0.15750
REFINISH STUCCO EXTERIOR WALL - 1ST FLOOR									8	0.02825	0.07420	0.02825
STUCCO Second Floor	SF	0.06002	0.08680	0.06002	1.51	0.00091	0.00033	0.00091	300	0.33241	0.96460	0.19279
REFINISH STUCCO EXTERIOR WALL - 2ND FLOOR									8	0.04417	0.07420	0.04417
STUCCO Third Floor	SF	0.08191	0.08680	0.08191	2.02	0.00130	0.00033	0.00130	300	0.40963	0.96460	0.23966
REFINISH STUCCO EXTERIOR WALL - 3RD FLOORS									8	0.05969	0.07420	0.05969
TERRACOTTA First Floor	SF	0.00175	0.01257	0.00175	0.05	0.00015	0.00108	0.00015	500	0.35009	3.41320	0.17505

See NOTES on the last page of this table for Explanation of Column Headings

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%) By Resources labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS Annual Maintenance and Repair labor	material	equipment	Replacement and High Costs Tasks yr	labor	material	equipment
TERRACOTTA Second Floor	SF	0.00457	0.01257	0.00457	0.12	0.00039	0.00108	0.00039	500	0.39819	3.41320	0.19910
TERRACOTTA Third Floor	SF	0.00618	0.01257	0.00618	0.16	0.00053	0.00108	0.00053	500	0.44928	3.41320	0.22464
WOOD, FINISHED 1 COAT 1 Fl	SF	0.05389	0.13227	0.05389	1.41	0.00018	0.00029	0.00018	125	0.33124	0.92220	0.18109
REFINISH WOOD FINISHED (S.CT) EXT.WALL - 1									5	0.02555	0.06360	0.02555
WOOD, FINISHED 1 COAT 2 Fl	SF	0.09113	0.13227	0.09113	2.29	0.00066	0.00029	0.00066	125	0.35893	0.92220	0.20150
REFINISH WOOD FINISHED (S.CT) EXT.WALL - 2									5	0.04119	0.06360	0.04119
WOOD, FINISHED 1 COAT 3 Fl	SF	0.12513	0.13227	0.12513	3.09	0.00092	0.00029	0.00092	125	0.44915	0.92220	0.25610
REFINISH WOOD FINISHED (S.CT) EXT.WALL -3R									5	0.05645	0.06360	0.05645
WOOD, FINISH MULTI-CT 1 Fl	SF	0.03705	0.12208	0.03705	1.00	0.00019	0.00031	0.00019	125	0.34502	0.97520	0.19487
REFINISH WOOD FINISHED (MULTI-CT) EXT.WALL									8	0.03120	0.10600	0.03120
WOOD, FINISH MULTI-CT 2 Fl	SF	0.06071	0.12208	0.06071	1.56	0.00066	0.00031	0.00066	125	0.37037	0.97520	0.21294
REFINISH WOOD FINISHED (MULTI-CT)EXT.WALL									8	0.04741	0.10600	0.04741
WOOD, FINISH MULTI-CT 3 Fl	SF	0.08153	0.12208	0.08153	2.05	0.00093	0.00031	0.00093	125	0.46592	0.97520	0.27287
REFINISH WOOD FINISHED (MULTI-CT) EXT.WALL									8	0.06323	0.10600	0.06323
WOOD SHAKES UNFINISH 1 Flr	SF	0.00217	0.00911	0.00217	0.06	0.00019	0.00078	0.00019	125	0.04355	0.71020	0.02178
WOOD SHAKES UNFINISH 2 Flr	SF	0.01158	0.00911	0.01158	0.28	0.00099	0.00078	0.00099	125	0.06097	0.71020	0.03049
WOOD SHAKES UNFINISH 3 Flr	SF	0.01675	0.00911	0.01675	0.41	0.00144	0.00078	0.00144	125	0.07813	0.71020	0.03907
WOOD SHAKES FINISHED 1 Flr	SF	0.06718	0.13934	0.06718	1.73	0.00036	0.00090	0.00036	125	0.07735	0.81620	0.05571
REFINISH WOOD SHAKES (FIN.) EXTERIOR WALL									5	0.03106	0.06360	0.03106
WOOD SHAKES FINISHED 2 Flr	SF	0.11889	0.13934	0.11889	2.95	0.00198	0.00090	0.00198	125	0.11154	0.81620	0.08106
REFINISH WOOD SHAKES (FIN.) EXTERIOR WALL									5	0.04728	0.06360	0.04728
WOOD SHAKES FINISHED 3 Flr	SF	0.16104	0.13934	0.16104	3.95	0.00287	0.00090	0.00287	125	0.14469	0.81620	0.10563
REFINISH WOOD SHAKES (FIN.)EXTERIOR WALL -									5	0.06298	0.06360	0.06298
ALUMINUM SIDING First Flr.	SF	0.05089	0.17658	0.05089	1.38	0.00437	0.01515	0.00437	80	0.09759	2.04580	0.06100
ALUMINUM SIDING Second Flr	SF	0.10086	0.17658	0.10086	2.56	0.00866	0.01515	0.00866	80	0.13334	2.04580	0.08660
ALUMINUM SIDING Third Flr.	SF	0.14181	0.17658	0.14181	3.53	0.01217	0.01515	0.01217	80	0.16869	2.04580	0.11188
ALUM. SIDING ANODIZED 1 Fl	SF	0.00115	0.01255	0.00115	0.04	0.00010	0.00108	0.00010	100	0.07319	2.12000	0.03660
ALUM. SIDING ANODIZED 2 Fl	SF	0.00554	0.01255	0.00554	0.14	0.00048	0.00108	0.00048	100	0.09347	2.12000	0.04674
ALUM. SIDING ANODIZED 3 Fl	SF	0.00796	0.01255	0.00796	0.20	0.00068	0.00108	0.00068	100	0.11362	2.12000	0.05681
STEEL (SELF-COATING) 1 Flr	SF	0.00490	0.02860	0.00490	0.14	0.00042	0.00245	0.00042	150	0.59007	5.53320	0.29504
STEEL (SELF-COATING) 2 Flr	SF	0.00739	0.02860	0.00739	0.20	0.00063	0.00245	0.00063	150	0.66209	5.53320	0.33105
STEEL (SELF-COATING) 3 Flr	SF	0.00974	0.02860	0.00974	0.26	0.00084	0.00245	0.00084	150	0.73385	5.53320	0.36693
STEEL (PAINTED) First Flr.	SF	0.03710	0.09646	0.03710	0.97	0.00063	0.00270	0.00063	150	0.63817	6.08440	0.34314
REFINISH STEEL (PAINTED) EXTERIOR WALL - 1									10	0.03875	0.08480	0.03875
STEEL (PAINTED) Second Flr	SF	0.05474	0.09646	0.05474	1.39	0.00104	0.00270	0.00104	150	0.72540	6.08440	0.39566
REFINISH STEEL (PAINTED) EXTERIOR WALL - 2									10	0.05563	0.08480	0.05563
STEEL (PAINTED) Third Flr.	SF	0.07205	0.09646	0.07205	1.80	0.00142	0.00270	0.00142	150	0.81718	6.08440	0.45039
REFINISH STEEL (PAINTED) EXTERIOR WALL -3R									10	0.07237	0.08480	0.07237
GLASS BLOCK First Floor	SF	0.00426	0.04463	0.00426	0.15	0.00037	0.00383	0.00037	300	1.04013	12.11580	0.52007
GLASS BLOCK Second Floor	SF	0.00735	0.04463	0.00735	0.22	0.00063	0.00383	0.00063	300	1.15713	12.11580	0.57857
GLASS BLOCK Third Floor	SF	0.00922	0.04463	0.00922	0.26	0.00079	0.00383	0.00079	300	1.27400	12.11580	0.63700
PLATE GLASS First Floor	SF	0.01449	0.34366	0.01449	0.69	0.00124	0.02949	0.00124	150	0.09906	8.48000	0.04953
PLATE GLASS Second Floor	SF	0.04531	0.34366	0.04531	1.42	0.00389	0.02949	0.00389	150	0.12194	8.48000	0.06097
PLATE GLASS Third Floor	SF	0.06243	0.34366	0.06243	1.82	0.00536	0.02949	0.00536	150	0.14469	8.48000	0.07235
FORMICA-VINYL First Floor	SF	0.00374	0.01593	0.00374	0.10	0.00032	0.00137	0.00032	40	0.02925	0.63600	0.01463
FORMICA-VINYL Second Floor	SF	0.02214	0.01593	0.02214	0.54	0.00190	0.00137	0.00190	40	0.04524	0.63600	0.02262
FORMICA-VINYL Third Floor	SF	0.03239	0.01593	0.03239	0.78	0.00278	0.00137	0.00278	40	0.06084	0.63600	0.03042
ASBESTOS First Floor	SF	0.00259	0.01609	0.00259	0.08	0.00022	0.00138	0.00022	100	0.04862	1.04940	0.02431
ASBESTOS Second Floor	SF	0.01395	0.01609	0.01395	0.35	0.00120	0.00138	0.00120	100	0.06643	1.04940	0.03322
ASBESTOS Third Floor	SF	0.02013	0.01609	0.02013	0.49	0.00173	0.00138	0.00173	100	0.08424	1.04940	0.04212
SYN VENEER-PLASTER 1st Fl	SF	0.03825	0.06430	0.03825	0.97	0.00041	0.00096	0.00041	160	0.06486	0.73140	0.04646
REFINISH SYTHETIC VENEER									7	0.02672	0.04240	0.02672
SYN. VENEER-PLASTER 2nd Fl	SF	0.08049	0.06430	0.08049	1.97	0.00235	0.00096	0.00235	160	0.09738	0.73140	0.07064
REFINISH SYTHETIC VENEER 2ND FLR.									7	0.04241	0.04240	0.04241
SYN. VENEER-PLASTER 3rd Fl	SF	0.11140	0.06430	0.11140	2.70	0.00342	0.00096	0.00342	160	0.12942	0.73140	0.09445
REFINISH SYNTHETIC VENEER 3RD FLR.									7	0.05717	0.04240	0.05717
PORCELAIN PANEL First Flr.	SF	0.02096	0.05946	0.02096	0.56	0.00180	0.00510	0.00180	125	0.08260	2.52174	0.02753
PORCELAIN PANEL Second Flr	SF	0.03566	0.05946	0.03566	0.90	0.00306	0.00510	0.00306	125	0.10390	2.52174	0.03463

See NOTES on the last page of this table for Explanation of Column Headings

COMPONENT DESCRIPTION		PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%)				ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS						
		By Resources			Washington	Annual Maintenance and Repair			Replacement and High Costs Tasks			
	um	labor	material	equipment	D.C. Total	labor	material	equipment	yr	labor	material	equipment
PORCELAIN PANEL Third Flr.	SF	0.04367	0.05946	0.04367	1.09	0.00375	0.00510	0.00375	125	0.12491	2.52174	0.04164
ALUM. CORRG. PANEL 1st Flr	SF	0.00345	0.02773	0.00345	0.11	0.00030	0.00238	0.00030	60	0.02074	1.24020	0.01037
ALUM. CORRG. PANEL 2nd Flr	SF	0.01991	0.02773	0.01991	0.48	0.00171	0.00238	0.00171	60	0.04971	1.24020	0.02486
ALUM. CORRG. PANEL 3rd Flr	SF	0.02897	0.02773	0.02897	0.68	0.00249	0.00238	0.00249	60	0.07080	1.24020	0.03540
EXT. GYPSUM BRD-PNTD 1 Flr	SF	0.06280	0.12524	0.06280	1.61	0.00034	0.00135	0.00034	100	0.08843	1.31122	0.05902
REFINISH EXTERIOR GYPSUM BOARD-PNTD FIRST									4	0.02276	0.04240	0.02276
EXT. GYPSUM BRD-PNTD 2 Flr	SF	0.12000	0.12524	0.12000	2.96	0.00186	0.00135	0.00186	100	0.11682	1.31122	0.07795
REFINISH EXTERIOR GYPSUM BOARD-PNTD SECOND									4	0.03806	0.04240	0.03806
EXT. CYPSUM BRD-PNTD 3 Flr	SF	0.16858	0.12524	0.16858	4.11	0.00269	0.00135	0.00269	100	0.15060	1.31122	0.10241
REFINISH EXTERIOR GYPSUM BOARD-PNTD FIRST									4	0.05311	0.04240	0.05311
EXT.GYPSUM BRD-COVERED 1Fl	SF	0.17251	1.66008	0.17251	5.74	0.00036	0.00148	0.00036	100	0.12397	1.43736	0.09456
REFINISH EXTERIOR GYPSUM BOARD COVERED FIR									4	0.06514	0.63600	0.06514
EXT.GYPSUM BRD-COVERED 2Fl	SF	0.24068	1.66008	0.24068	7.35	0.00188	0.00148	0.00188	100	0.16229	1.43736	0.12349
REFINISH EXTERIOR GYPSUM BOARD-COVERED 2ND									4	0.08468	0.63600	0.08468
EXT.GYPSUM BRD-COVERED 3Fl	SF	0.30024	1.66008	0.30024	8.76	0.00272	0.00148	0.00272	100	0.20035	1.43736	0.15216
REFINISH EXTERIOR GYPSUM BOARD COVERED 3RD									4	0.10396	0.63600	0.10396
MASONITE PANEL, SEALED 1Fl	SF	0.00227	0.00652	0.00227	0.06	0.00019	0.00056	0.00019	100	0.05766	0.54060	0.02883
MASONITE PANEL, SEALED 2Fl	SF	0.01174	0.00652	0.01174	0.28	0.00101	0.00056	0.00101	100	0.07645	0.54060	0.03822
MASONITE PANEL, SEALED 3Fl	SF	0.01696	0.00652	0.01696	0.41	0.00145	0.00056	0.00145	100	0.09498	0.54060	0.04749
FIBERGLASS PANEL,RIGID 1Fl	SF	0.06375	0.19277	0.06375	1.70	0.00043	0.00244	0.00043	150	0.06536	1.79405	0.04748
REFINISH FIBERGLASS PANELS RIGID FIRST FLO									4	0.02276	0.06360	0.02276
FIBERGLASS PANEL,RIGID 2Fl	SF	0.12799	0.19277	0.12799	3.22	0.00255	0.00244	0.00255	150	0.09144	1.79405	0.06526
REFINISH FIBERGLASS PANELS, RIGID SECOND F									4	0.03806	0.06360	0.03806
FIBERGLASS PANEL,RIGID 3Fl	SF	0.18042	0.19277	0.18042	4.46	0.00371	0.00244	0.00371	150	0.12292	1.79405	0.08856
REFINISH FIBERGLASS PANEL, RIGID THIRD FLO									4	0.05311	0.06360	0.05311
EXTERIOR DOORS												
METAL DOORS												
ALUMINUM (PLAIN/ANODIZED)	CT	0.70112	57.76311	0.70112	74.35	0.06016	4.95668	0.06016	65	2.23574	265.00000	2.23574
AL. (P&L) FRAME/DOOR	CT	1.05027	60.96559	1.05027	85.81	0.09012	5.23148	0.09012	65	2.73004	327.87125	2.73004
AL. SLIDING EXT.(P&A) DOOR	CT	1.32109	144.35505	1.32109	175.61	0.11336	12.38716	0.11336	65	2.73004	848.38075	1.36502
AL.(WOOD CORE) EXT. DOOR	CT	1.05027	59.74908	1.05027	84.60	0.09012	5.12709	0.09012	65	2.73004	385.84000	2.73004
AL.(INSUL)P&A EXT. DOOR	CT	1.05027	59.74908	1.05027	84.60	0.09012	5.12709	0.09012	65	2.73004	381.60000	2.73004
STEEL (PAINTED)	CT	1.27231	42.49790	1.27231	72.60	0.10918	3.64676	0.10918	80	2.59350	124.74080	2.59350
STEEL PAINTED EXT. DOOR	CT	1.84622	45.70038	1.84622	89.38	0.15842	3.92157	0.15842	80	3.14685	187.53732	3.14685
ST. SLIDING PNTD EXT. DOOR	CT	1.66083	90.88060	1.66083	130.18	0.14252	7.79850	0.14252	80	3.14685	707.74080	1.78183
ST.(INSUL CORE)PNTD EXT.DR	CT	1.84622	44.48387	1.84622	88.17	0.15842	3.81718	0.15842	80	3.14685	241.34080	3.14685
STEEL (UNPAINTED)	CT	0.42411	34.94078	0.42411	44.98	0.03639	2.99828	0.03639	80	2.26369	145.22000	2.26369
ST.(GLASS)UNPNTD EXT. DOOR	CT	0.77327	38.14326	0.77327	56.44	0.06635	3.27309	0.06635	80	2.73004	220.48000	2.73004
ST.SLIDING UNPNTD EXT DOOR	CT	0.58790	86.05709	0.58790	99.97	0.05045	7.38459	0.05045	80	2.73004	844.82000	1.36502
ST.(INSUL)UNPNTD EXT. DOOR	CT	0.77330	36.92675	0.77330	55.22	0.06636	3.16870	0.06636	80	2.73004	285.14000	2.73004
FULLY GLAZED DOORS												
ALUMINIUM FRAME	CT	1.05107	60.74621	1.05107	85.61	0.09019	5.21266	0.09019	65	2.23574	395.38000	2.23574
GLAZED AL.SLIDING EXT.DOOR	CT	0.91427	43.97997	0.91427	65.61	0.07845	3.77394	0.07845	65	5.63216	636.00000	2.81608
WOOD FRAME (PAINTED)	CT	1.31052	76.53954	1.31052	107.55	0.11246	6.56789	0.11246	50	2.35677	122.57310	2.35677
GLAZED WOOD SLID. EXT. DR	CT	1.45574	52.96586	1.45574	87.41	0.12492	4.54502	0.12492	50	5.79892	460.12480	2.98284
WOOD DOORS												
HOLLOW CORE (PAINTED)	CT	1.78943	60.64192	1.78943	102.98	0.15355	5.20371	0.15355	30	2.58492	196.82080	2.58492
HOL.CORE SLID. WOOD EXT.DR	CT	2.18888	46.43531	2.18888	98.22	0.18783	3.98463	0.18783	30	6.05336	211.78800	3.23728
SOLID CORE (PAINTED)	CT	1.35832	37.27104	1.35832	69.41	0.11656	3.19824	0.11656	40	2.58492	223.32080	2.58492
SOLID SLID. WOOD EXT. DOOR	CT	1.70305	29.60828	1.70305	69.90	0.14614	2.54070	0.14614	40	6.05336	213.90800	3.23728
SOLID CORE GLASS PNTD EXT.	CT	1.70750	40.47352	1.70750	80.87	0.14652	3.47305	0.14652	40	2.58557	239.22080	2.58557
LOUVERED EXTERIOR DOOR												
METAL GRATED PNTD EXT.DOOR	CT	1.98025	13.20144	1.98025	60.05	0.16993	1.13282	0.16993	150	21.97979	218.02080	11.33121
MET. GRATED UNPTD EXT.DOOR	CT	0.21695	3.12528	0.21695	8.26	0.01862	0.26818	0.01862	150	21.29716	214.12000	10.64858
MET.WIRE MESH PNTD EXT. DR	CT	2.33091	10.10866	2.33091	65.26	0.20002	0.86743	0.20002	150	7.33475	202.12080	4.10780
METAL WIRE PNTD EXT.DOOR	CT	0.05557	0.03250	0.05557	1.35	0.00477	0.00279	0.00477	150	6.45389	198.22000	3.22695
AL. LOUVERED EXT. DOOR	CT	2.47881	43.84866	2.47881	102.50	0.21271	3.76267	0.21271	65	6.04897	508.46080	3.23289
STEEL LOUVERED EXT. DOOR	CT	1.92334	29.50979	1.92334	75.02	0.16504	2.53225	0.16504	80	6.04897	310.77080	3.23289

See NOTES on the last page of this table for Explanation of Column Headings

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%) By Resources: labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS Annual Maintenance and Repair: labor	material	equipment	Replacement and High Costs Tasks: yr	labor	material	equipment
WOOD LOUVERED EXT. DOOR	CT	3.81847	91.96726	3.81847	182.31	0.32766	7.89175	0.32766	40	6.04897	311.30080	3.23289
EXTERIOR GATE												
ALUMINUM EXTERIOR GATE	CT	1.65901	38.42693	1.65901	77.68	0.14236	3.29743	0.14236	40	2.25334	421.24400	1.22691
STEEL EXTERIOR GATE	CT	1.45383	28.06987	1.45383	62.47	0.12475	2.40869	0.12475	65	2.25334	256.94400	1.22691
WOOD EXTERIOR GATE	CT	2.45206	205.17843	2.45206	263.19	0.20724	17.56623	0.20724	25	2.25334	475.30400	1.22691
REPLACE WOOD EXTERIOR GATE (WALK & DRIVEWA									25	2.05286	472.76000	1.02643
WROUGHT IRON EXT. GATE	CT	1.55138	30.20374	1.55138	66.91	0.13312	2.59179	0.13312	65	2.25334	256.94400	1.22691
SCREEN/STORM DOORS												
ALUMINUM (PLAIN/ANODIZED)	CT	4.04144	140.40622	4.04144	236.03	0.29722	8.52274	0.29722	20	2.23574	159.00000	2.23574
PLASTIC	CT	2.81886	130.27177	2.81886	196.97	0.19169	8.52274	0.19169	20	2.26369	119.78000	2.26369
ROLL-UP DOORS												
ST.FRAME-SINGLE (PAINTED)	CT	5.31996	128.07754	5.31996	253.95	0.45651	10.99038	0.45651	35	4.84587	176.85040	2.67316
ST. FRAME-DOUBLE (PAINTED)	CT	9.71421	163.81823	9.71421	393.66	0.83358	14.05731	0.83358	35	5.38802	445.73000	3.21531
AL. SINGLE ROLL-UP DOOR	CT	4.58113	238.03362	4.58113	346.42	0.38464	20.35692	0.38464	24	4.84587	135.24540	2.67316
REPLACE ALUMINUM SINGLE ROLL-UP DOOR									24	4.34542	131.17500	2.17271
AL. DOUBLE ROLL-UP DOOR	CT	8.68278	271.39445	8.68278	476.83	0.72744	23.14504	0.72744	24	5.38802	478.85500	3.21531
REPLACE ALUMINUM DOUBLE ROLL-UP DOOR									24	4.34542	470.37500	2.17271
WOOD SINGLE ROLL-UP DOOR	CT	4.63102	278.02377	4.63102	387.59	0.38284	23.73903	0.38284	16	4.84587	239.92040	2.67316
REPLACE WOOD SINGLE ROLL-UP DOOR									16	4.34542	235.85000	2.17271
WOOD DOUBLE ROLL-UP DOOR	CT	8.77279	403.37982	8.77279	610.94	0.72249	34.36772	0.72249	16	5.38802	538.48000	3.21531
REPLACE WOOD DOUBLE ROLL-UP DOOR									16	4.34542	530.00000	2.17271
AL (ONE LEAF) SPRING DOOR	CT	4.27182	98.25814	4.27182	199.33	0.36657	8.43157	0.36657	48	11.41516	424.38160	6.70848
STEEL(ONE LEAF)SPRING DOOR	CT	4.11833	77.45471	4.11833	174.89	0.35340	6.64642	0.35340	70	11.41516	387.28160	6.70848
WOOD(ONE LEAF) SPRING DOOR	CT	3.95328	152.16139	3.95328	245.70	0.33923	13.05703	0.33923	32	11.10961	440.28160	6.40293
EXTERIOR WINDOWS												
OPERABLE WINDOWS												
ALUMINIUM OPER. First Flr.	CT	0.28210	2.10453	0.28210	8.78	0.02421	0.18059	0.02421	75	3.30634	154.76000	3.30634
ALUMINIUM OPER. Second Flr	CT	0.46171	2.10453	0.46171	13.03	0.03962	0.18059	0.03962	75	4.21782	154.76000	4.21782
ALUMINIUM OPER. Third Flr.	CT	3.14851	2.10453	3.14851	76.60	0.27018	0.18059	0.27018	75	5.12929	154.76000	5.12929
STEEL FRAME-OPER(PNTD) 1Fl	CT	0.86084	2.68615	0.86084	23.05	0.07387	0.23050	0.07387	80	3.59195	275.80999	3.59195
STEEL FRAME-OPER(PNTD) 2Fl	CT	3.97651	2.68615	3.97651	96.77	0.34123	0.23050	0.34123	80	5.95241	275.80999	5.95241
STEEL FRAME-OPER(PNTD) 3Fl	CT	5.78332	2.68615	5.78332	139.52	0.49627	0.23050	0.49627	80	7.70654	275.80999	7.70654
WOOD FRAME-OPER(PNTD) 1 Fl	CT	1.03088	2.49139	1.03088	26.88	0.08846	0.21379	0.08846	50	3.63199	94.51999	3.63199
WOOD FRAME-OPER(PNTD) 2 Fl	CT	3.96524	2.39118	3.96524	96.21	0.34026	0.20519	0.34026	50	5.99245	94.51999	5.99245
WOOD FRAME-OPER(PNTD) 3 Fl	CT	5.77204	2.39118	5.77204	138.96	0.49530	0.20519	0.49530	50	7.74658	94.51999	7.74658
PLASTIC (WOOD CORE)FRM 1Fl	CT	0.19820	2.27190	0.19820	6.96	0.01701	0.19495	0.01701	75	3.30634	137.80000	3.30634
PLASTIC (WOOD CORE)FRM 2Fl	CT	0.38355	2.27190	0.38355	11.35	0.03291	0.19495	0.03291	75	4.21782	137.80000	4.21782
PLASTIC (WOOD CORE)FRM 3Fl	CT	0.48861	2.27190	0.48861	13.83	0.04193	0.19495	0.04193	75	5.12929	137.80000	5.12929
GLASS BLOCK-OPER First Flr	CT	0.62752	5.06330	0.62752	19.91	0.05385	0.43448	0.05385	100	3.02718	281.67592	3.02718
GLASS BLOCK-OPER Second Fl	CT	2.40707	5.06330	2.40707	62.01	0.20655	0.43448	0.20655	100	4.47642	281.67592	4.47642
GLASS BLOCK-OPER Third Flr	CT	3.43657	5.06330	3.43657	86.37	0.29489	0.43448	0.29489	100	5.31882	281.67592	5.31882
ALUMINUM DOUBLE-OPER 1 Flr	CT	0.51389	3.88448	0.51389	16.04	0.04410	0.33333	0.04410	75	3.30634	213.06000	3.30634
ALUMINUM DOUBLE-OPER 2 Flr	CT	0.69350	3.88448	0.69350	20.29	0.05951	0.33333	0.05951	75	4.21782	213.06000	4.21782
ALUMINUM DOUBLE-OPER 3 Flr	CT	0.79282	3.88448	0.79282	22.64	0.06803	0.33333	0.06803	75	5.12929	213.06000	5.12929
STEEL FRAME(DBL)-OPER 1 Fl	CT	1.12581	4.96966	1.12581	31.61	0.09661	0.42645	0.09661	80	3.60833	394.73997	3.60833
STEEL FRAME(DBL)-OPER 2 Fl	CT	4.24149	4.96966	4.24149	105.32	0.36396	0.42645	0.36396	80	5.96879	394.73997	5.96879
STEEL FRAME(DBL)-OPER 3 Fl	CT	6.04829	4.96966	6.04829	148.07	0.51901	0.42645	0.51901	80	7.72292	394.73997	7.72292
WOOD FRAME(DBL)-OPER 1 Flr	CT	1.67481	4.76469	1.67481	44.39	0.14372	0.40886	0.14372	50	3.96973	123.45184	3.96973
WOOD FRAME(DBL)-OPER 2 Flr	CT	4.79049	4.76469	4.79049	118.11	0.41107	0.40886	0.41107	50	6.33019	123.45184	6.33019
WOOD FRAME(DBL)-OPER 3 Flr	CT	6.59729	4.76469	6.59729	160.86	0.56612	0.40886	0.56612	50	8.08432	123.45184	8.08432
PLASTIC (WOOD)FRM-OPER 1Fl	CT	0.33909	4.07314	0.33909	12.10	0.02910	0.34952	0.02910	70	3.30634	187.62000	3.30634
PLASTIC (WOOD)FRM-OPER 2Fl	CT	0.52444	4.07314	0.52444	16.48	0.04500	0.34952	0.04500	70	4.21782	187.62000	4.21782
PLASTIC (WOOD)FRM-OPER 3Fl	CT	0.62950	4.07314	0.62950	18.97	0.05402	0.34952	0.05402	70	5.12929	187.62000	5.12929
INOPERABLE WINDOWS												
ALUMINIUM-FIXED First Flr.	CT	0.28210	2.06344	0.28210	8.74	0.02421	0.17706	0.02421	75	3.30634	122.96000	3.30634
ALUMINIUM-FIXED Second Flr	CT	0.46171	2.06344	0.46171	12.99	0.03962	0.17706	0.03962	75	4.21782	122.96000	4.21782
ALUMINIUM-FIXED Third Flr.	CT	0.56104	2.06344	0.56104	15.34	0.04814	0.17706	0.04814	75	5.12929	122.96000	5.12929
STEEL FRAME(PNTD)-FXD 1 Fl	CT	0.86084	2.49716	0.86084	22.86	0.07387	0.21428	0.07387	80	3.59195	129.52999	3.59195

See NOTES on the last page of this table for Explanation of Column Headings

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%) By Resources labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS Annual Maintenance and Repair labor	material	equipment	yr	Replacement and High Costs Tasks labor	material	equipment
STEEL FRAME(PNTD)-FXD 2 Fl	CT	3.97651	2.49716	3.97651	96.58	0.34123	0.21428	0.34123	80	5.95241	129.52999	5.95241
STEEL FRAME(PNTD)-FXD 3 Fl	CT	5.78332	2.49716	5.78332	139.33	0.49627	0.21428	0.49627	80	7.70654	129.52999	7.70654
WOOD FRAME(PNTD)-FXD 1 Flr	CT	1.87847	2.80825	1.87847	47.25	0.16119	0.24098	0.16119	50	4.13977	229.25998	4.13977
WOOD FRAME(PNTD)-FXD 2 Flr	CT	4.64960	2.80825	4.64960	112.82	0.39898	0.24098	0.39898	50	6.33019	229.25998	6.33019
WOOD FRAME(PNTD)-FXD 3 Flr	CT	8.10176	2.97527	8.10176	194.66	0.69522	0.25531	0.69522	50	8.08432	229.25998	8.08432
PLASTIC (WOOD)FRM-FXD 1 Fl	CT	0.19820	2.46716	0.19820	7.16	0.01701	0.21171	0.01701	70	3.30634	238.50000	3.30634
PLASTIC (WOOD)FRM-FXD 2 Fl	CT	0.38355	2.46716	0.38355	11.54	0.03291	0.21171	0.03291	70	4.21782	238.50000	4.21782
PLASTIC (WOOD)FRM-FXD 3 Fl	CT	0.48861	2.46716	0.48861	14.03	0.04193	0.21171	0.04193	70	5.12929	238.50000	5.12929
GLASS BLOCK-FIXED 1st Flr.	CT	0.62752	5.06330	0.62752	19.91	0.05385	0.43448	0.05385	100	3.02718	150.23592	3.02718
GLASS BLOCK-FIXED 2nd Flr.	CT	2.41564	5.06330	2.41564	62.22	0.20729	0.43448	0.20729	100	4.47642	150.23592	4.47642
GLASS BLOCK-FIXED 3rd Flr.	CT	3.44514	5.06330	3.44514	86.58	0.29563	0.43448	0.29563	100	5.34482	150.23592	5.34482
ALUMINIUM DBL-FXD 1st Flr.	CT	0.51389	3.82286	0.51389	15.98	0.04410	0.32804	0.04410	75	3.30634	165.36000	3.30634
ALUMINIUM DBL-FXD 2nd Flr.	CT	0.69350	3.82286	0.69350	20.23	0.05951	0.32804	0.05951	75	4.21782	165.36000	4.21782
ALUMINIUM DBL-FXD 3rd Flr.	CT	0.79282	3.82286	0.79282	22.58	0.06803	0.32804	0.06803	75	5.12929	165.36000	5.12929
STEEL FRAME(DBL)-FXD 1 Flr	CT	1.12581	4.67715	1.12581	31.31	0.09661	0.40135	0.09661	80	3.60833	175.31552	3.60833
STEEL FRAME(DBL)-FXD 2 Flr	CT	4.24149	4.67715	4.24149	105.03	0.36396	0.40135	0.36396	80	5.96879	175.31552	5.96879
STEEL FRAME(DBL)-FXD 3 Flr	CT	6.04829	4.67715	6.04829	147.78	0.51901	0.40135	0.51901	80	7.72292	175.31552	7.72292
WOOD FRAME(DBL)-FXD 1st Fl	CT	2.04418	5.57667	2.04418	53.94	0.17541	0.47854	0.17541	50	3.96973	323.89996	3.96973
WOOD FRAME(DBL)-FXD 2nd Fl	CT	5.96665	5.57667	5.96665	146.75	0.51200	0.47854	0.51200	50	6.33019	323.89996	6.33019
WOOD FRAME(DBL)-FXD 3rd Fl	CT	8.24265	5.57667	8.24265	200.60	0.70731	0.47854	0.70731	50	8.08432	323.89996	8.08432
PLASTIC (WOOD)DBL-FXD 1 Fl	CT	0.33909	4.36705	0.33909	12.39	0.02910	0.37474	0.02910	70	3.30634	339.20000	3.30634
PLASTIC (WOOD)DBL-FXD 2 Fl	CT	0.52141	4.36705	0.52141	16.70	0.04474	0.37474	0.04474	70	4.21782	339.20000	4.21782
PLASTIC (WOOD)DBL-FXD 3 Fl	CT	0.62950	4.36705	0.62950	19.26	0.05402	0.37474	0.05402	70	5.12929	339.20000	5.12929
LOUVERS & SHUTTERS												
WOOD LOUVER First Floor	CT	2.55787	41.93279	2.55787	102.45	0.21949	3.59827	0.21949	75	5.95304	81.28080	5.95304
WOOD LOUVER Second Floor	CT	5.49241	42.92434	5.49241	172.87	0.47131	3.68335	0.47131	75	8.05853	81.28080	8.05853
WOOD LOUVER Third Floor	CT	6.20684	41.93279	6.20684	188.79	0.53261	3.59827	0.53261	75	10.16402	81.28080	10.16402
ALUM. LOUVER First Floor	CT	2.36586	64.39589	2.36586	120.37	0.20302	5.52584	0.20302	80	5.95304	317.66080	5.95304
ALUM. LOUVER Second Floor	CT	4.15322	64.39589	4.15322	162.66	0.35639	5.52584	0.35639	80	8.05853	317.66080	8.05853
ALUM. LOUVER Third Floor	CT	5.93004	64.39589	5.93004	204.70	0.50886	5.52584	0.50886	80	10.16402	317.66080	10.16402
STEEL LOUVER First Floor	CT	2.30552	23.65996	2.30552	78.21	0.19784	2.03027	0.19784	150	5.95304	198.94080	5.95304
STEEL LOUVER Second Floor	CT	4.07706	23.65996	4.07706	120.12	0.34985	2.03027	0.34985	150	8.05853	198.94080	8.05853
STEEL LOUVER Third Floor	CT	5.84304	23.65996	5.84304	161.91	0.50139	2.03027	0.50139	150	10.16402	198.94080	10.16402
WOOD SHUTTER First Floor	CT	2.55787	41.93279	2.55787	102.45	0.21949	3.59827	0.21949	75	2.41972	81.28080	2.41972
WOOD SHUTTER Second Floor	CT	4.39552	41.93279	4.39552	145.93	0.37718	3.59827	0.37718	75	4.17188	81.28080	4.17188
WOOD SHUTTER Third Floor	CT	6.20684	41.93279	6.20684	188.79	0.53261	3.59827	0.53261	75	5.92404	81.28080	5.92404
ALUM. SHUTTER First Floor	CT	2.39093	76.30495	2.39093	132.87	0.20517	6.54776	0.20517	80	2.41972	317.66080	2.41972
ALUM. SHUTTER Second Floor	CT	4.18484	76.30495	4.18484	175.32	0.35910	6.54776	0.35910	80	4.17188	317.66080	4.17188
ALUM. SHUTTER Third Floor	CT	5.96617	76.30495	5.96617	217.46	0.51196	6.54776	0.51196	80	5.92404	317.66080	5.92404
STEEL SHUTTER First Floor	CT	2.36586	41.56247	2.36586	97.54	0.20302	3.56649	0.20302	150	2.41972	198.94080	2.41972
STEEL SHUTTER Second Floor	CT	4.15322	41.56247	4.15322	139.83	0.35639	3.56649	0.35639	150	4.17188	198.94080	4.17188
STEEL SHUTTER Third Floor	CT	5.93004	41.56247	5.93004	181.87	0.50886	3.56649	0.50886	150	5.92404	198.94080	5.92404
WINDOW COV. SPECIAL EXT.												
ALUM. FRAME STORM WNDW 1Fl	CT	2.51774	2.25730	2.51774	61.83	0.21605	0.19370	0.21605	80	2.63991	111.53998	2.63991
ALUM. FRAME STORM WNDW 2Fl	CT	4.72966	2.25730	4.72966	114.16	0.40585	0.19370	0.40585	80	4.41409	111.53998	4.41409
ALUM. FRAME STORM WNDW 3Fl	CT	6.75249	2.25730	6.75249	162.02	0.57943	0.19370	0.57943	80	6.18827	111.53998	6.18827
STEEL FRAME STORM WNDW 1Fl	CT	2.10027	2.19091	2.10027	51.88	0.18022	0.18800	0.18022	100	2.63991	89.27998	2.63991
STEEL FRAME STORM WNDW 2Fl	CT	4.00834	2.19091	4.00834	97.03	0.34396	0.18800	0.34396	100	4.41409	89.27998	4.41409
STEEL FRAME STORM WNDW 3Fl	CT	5.83916	2.19091	5.83916	140.35	0.50106	0.18800	0.50106	100	6.18827	89.27998	6.18827
WOOD FRAME STORM WNDW 1 Fl	CT	2.81782	2.30501	2.81782	68.97	0.24180	0.19779	0.24180	50	2.63991	93.89098	2.63991
WOOD FRAME STORM WNDW 2 Fl	CT	5.24813	2.30501	5.24813	126.48	0.45034	0.19779	0.45034	50	4.41409	93.89098	4.41409
WOOD FRAME STORM WNDW 3 Fl	CT	7.40891	2.30501	7.40891	177.60	0.63576	0.19779	0.63576	50	6.18827	93.89098	6.18827
METAL WINDOW GRATING 1stFl	CT	3.32832	10.34215	3.32832	89.09	0.28560	0.88746	0.28560	150	23.23632	116.12300	23.23632
METAL WINDOW GRATING 2ndFl	CT	5.19643	10.34215	5.19643	133.29	0.44591	0.88746	0.44591	150	27.07014	116.12300	27.07014
METAL WINDOW GRATING 3rdFl	CT	7.06213	10.34215	7.06213	177.43	0.60600	0.88746	0.60600	150	30.90396	116.12300	30.90396
METAL WIRE MESH COVER 1 Fl	CT	3.56861	7.24937	3.56861	91.68	0.30622	0.62207	0.30622	150	4.10490	95.59080	4.10490
METAL WIRE MESH COVER 2 Fl	CT	5.46074	7.24937	5.46074	136.45	0.46859	0.62207	0.46859	150	6.02557	95.59080	6.02557
METAL WIRE MESH COVER 3 Fl	CT	7.35047	7.24937	7.35047	181.16	0.63075	0.62207	0.63075	150	7.94625	95.59080	7.94625

See NOTES on the last page of this table for Explanation of Column Headings

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION		PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%)				ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS						
		By Resources			Washington	Annual Maintenance and Repair			Replacement and High Costs Tasks			
	um	labor	material	equipment	D.C. Total	labor	material	equipment	yr	labor	material	equipment
ALUM.FRM SCRN WNDW CVR 1Fl	CT	1.84791	0.72959	1.84791	44.45	0.15857	0.06261	0.15857	70	3.08433	42.39618	3.08433
ALUM.FRM SCRN WNDW CVR 2Fl	CT	3.56648	0.72959	3.56648	85.11	0.30604	0.06261	0.30604	70	4.90295	42.39618	4.90295
ALUM.FRM SCRN WNDW CVR 3Fl	CT	5.28333	0.72959	5.28333	125.73	0.45336	0.06261	0.45336	70	6.72157	42.39618	6.72157
STEEL FRM SCRN WNDW CVR 1F	CT	1.84791	0.72959	1.84791	44.45	0.15857	0.06261	0.15857	80	3.08433	39.39638	3.08433
STEEL FRM SCRN WNDW CVR 2F	CT	3.56648	0.72959	3.56648	85.11	0.30604	0.06261	0.30604	80	4.90295	39.39638	4.90295
STEEL FRM SCRN WNDW CVR 3F	CT	5.28333	0.72959	5.28333	125.73	0.45336	0.06261	0.45336	80	6.72157	39.39638	6.72157
WOOD FRM SCRN WNDW CVR 1Fl	CT	1.84791	0.72959	1.84791	44.45	0.15857	0.06261	0.15857	40	3.08433	40.02178	3.08433
WOOD FRM SCRN WNDW CVR 2Fl	CT	3.56648	0.72959	3.56648	85.11	0.30604	0.06261	0.30604	40	4.90295	40.02178	4.90295
WOOD FRM SCRN WNDW CVR 3Fl	CT	5.28333	0.72959	5.28333	125.73	0.45336	0.06261	0.45336	40	6.72157	40.02178	6.72157
LEAD-LINED WNDW(W/FR) 1Flr	CT	2.10027	2.19091	2.10027	51.88	0.18022	0.18800	0.18022	100	2.63991	248.28316	1.77290
LEAD-LINED WNDW(W/FR) 2Flr	CT	4.00834	2.19091	4.00834	97.03	0.34396	0.18800	0.34396	100	4.41409	248.28316	3.08283
LEAD-LINED WNDW(W/FR) 3Flr	CT	5.83916	2.19091	5.83916	140.35	0.50106	0.18800	0.50106	100	6.18827	248.28316	4.39277
EXTERIOR PORCHES												
DECKS												
CONCRETE	SF	0.03805	0.11315	0.03805	1.01	0.00327	0.00971	0.00327	300	1.24579	17.78680	0.63349
WOOD	SF	0.03254	0.22958	0.03254	1.00	0.00279	0.01970	0.00279	200	0.06968	2.84080	0.04277
METAL DECKING-PORCH	SF	0.03669	0.08461	0.03669	0.95	0.00315	0.00726	0.00315	65	0.32421	0.96460	0.17285
RAILINGS												
WROUGHT IRON	LF	0.07955	0.18900	0.07955	2.07	0.00683	0.01622	0.00683	200	4.32328	53.08480	2.18088
WOOD	LF	0.04877	0.16872	0.04877	1.32	0.00419	0.01448	0.00419	100	0.37154	4.93536	0.19409
STEEL RAILING PAINTED	LF	0.07955	0.18330	0.07955	2.07	0.00683	0.01573	0.00683	200	2.18088	27.11480	1.10968
STEEL RAILING UNPAINTED	LF	0.03121	0.07669	0.03121	0.82	0.00268	0.00658	0.00268	200	2.14240	27.03000	1.07120
DECK SUPPORT MEMBERS												
CONCRETE	SF	0.03474	0.11114	0.03474	0.93	0.00298	0.00954	0.00298	500	3.60971	17.78680	1.81545
WOOD	SF	0.01286	0.59898	0.01286	0.90	0.00110	0.05140	0.00110	100	0.19279	4.74880	0.10433
CLAY BRICK	SF	0.03254	0.11817	0.03254	0.89	0.00279	0.01014	0.00279	500	1.12554	2.32140	0.57343
STEEL EXT. PORCH SUPPORT	SF	0.01454	0.14017	0.01454	0.48	0.00125	0.01203	0.00125	200	0.19279	27.51760	0.10433
COLUMNS												
METAL	LF	0.07980	0.80463	0.07980	2.69	0.00685	0.06905	0.00685	200	0.22945	18.06240	0.13507
WOOD	LF	0.03753	0.41518	0.03753	1.30	0.00322	0.03563	0.00322	200	0.23842	1.20840	0.12851
CLAY BRICK	LF	0.04817	0.47457	0.04817	1.61	0.00413	0.04072	0.00413	500	1.13152	9.20080	0.57779
EXTERIOR ORNAMENT												
CORNICES												
STONE	LF	0.01706	0.00038	0.01706	0.40	0.00146	0.00003	0.00146	300	0.26507	95.40000	0.13254
WOOD	LF	0.07681	0.11756	0.07681	1.93	0.00659	0.01009	0.00659	200	0.28496	3.52980	0.17251
EXTERIOR STAIRS												
RAILINGS												
WOOD	LF	0.02265	0.20010	0.02265	0.74	0.00194	0.01717	0.00194	100	0.16835	3.87536	0.09210
METAL	LF	0.03769	0.15401	0.03769	1.05	0.00323	0.01322	0.00323	300	0.78195	26.61236	0.40170
WROUGHT IRON EXT.ST. RAIL.	LF	0.07955	0.18878	0.07955	2.07	0.00683	0.01620	0.00683	200	2.18088	27.11480	1.10968
STEEL UNPNTD. EXT. STAIR	LF	0.01955	0.01252	0.01955	0.48	0.00168	0.00107	0.00168	300	2.14240	27.03000	1.07120
STEPS												
CONCRETE	SF	0.01475	0.01490	0.01475	0.36	0.00127	0.00128	0.00127	300	2.93605	16.87520	1.46803
WOOD	SF	0.02624	0.13673	0.02624	0.76	0.00225	0.01173	0.00225	100	0.46410	3.68456	0.23998
METAL	SF	0.02230	0.32536	0.02230	0.85	0.00191	0.02792	0.00191	300	2.16216	35.06480	1.09181
MASONRY STEPS (UNPAINTED)	SF	0.00826	0.01156	0.00826	0.21	0.00071	0.00099	0.00071	400	1.19119	2.23660	0.59560
MASONARY STEPS (PAINTED)	SF	0.04261	0.11386	0.04261	1.12	0.00366	0.00977	0.00366	400	1.61909	2.30020	0.82020
QUARRY TILE STEPS	SF	0.01158	0.01805	0.01158	0.29	0.00099	0.00155	0.00099	300	1.59774	2.49100	0.79887
EXTERIOR HARDWARE												
HINGES												
BRASS	CT	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	60	0.21151	19.08000	0.21151
LOCK SET												
BRASS	CT	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	30	1.64840	124.02000	1.64840
DOOR CLOSER												
BRASS	CT	0.17907	32.65224	0.17907	36.39	0.00000	0.00000	0.00000	15	0.49413	90.10000	0.49413
DEADBOLT												
BRASS	CT	0.24274	20.54280	0.24274	26.29	0.00000	0.00000	0.00000	20	0.93938	79.50000	0.93938
WEATHER STRIPING												

See NOTES on the last page of this table for Explanation of Column Headings

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE) PAGE 8

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%)				ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS						
		By Resources			Washington	Annual Maintenance and Repair			Replacement and High Costs Tasks			
		labor	material	equipment	D.C. Total	labor	material	equipment	yr	labor	material	equipment
BRASS EXIT BOLT METAL	CT	0.17213	6.84760	0.17213	10.92	0.00000	0.00000	0.00000	20	0.66612	26.50000	0.66612
	CT	0.37940	78.10080	0.37940	87.08	0.00000	0.00000	0.00000	25	2.05972	424.00000	2.05972

See NOTES on the last page of this table for Explanation of Column Headings

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%) By Resources: labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS: Annual Maintenance and Repair: labor	material	equipment	Replacement and High Costs Tasks: yr	labor	material	equipment
ARCHITECTURE												
INTERIOR PARTITION												
MOVABLE PARTITION-METAL												
MOVABLE PARTITION - STEEL	SF	0.00632	0.00000	0.00632	0.15	0.00054	0.00000	0.00054	100	0.22022	34.98000	0.11011
MOVABLE PARTITION-FABRIC												
MOVEABLE PARTITIONS -FABR.	SF	0.00323	0.01777	0.00323	0.09	0.00028	0.00153	0.00028	100	0.22022	51.91880	0.11011
INTERIOR DOORS												
METAL DOORS												
ST. PAINTED INTERIOR DOOR	CT	1.48709	42.49790	1.48709	77.68	0.12761	3.64676	0.12761	80	3.14685	124.74080	3.14685
ST.(W/SAFETY GLASS)PAINTED	CT	1.83627	45.70038	1.83627	89.15	0.15757	3.92157	0.15757	80	3.14685	187.53732	3.14685
ST. SLIDING PNTD. INT.DOOR	CT	1.66085	80.60390	1.66085	119.90	0.14252	6.91665	0.14252	80	3.14685	707.74080	3.14685
ST.(INSUL. CORE)PNTD INT.	CT	1.83627	44.48387	1.83627	87.93	0.15757	3.81718	0.15757	80	3.14685	241.34080	3.14685
STEEL UNPAINTED INT. DOOR	CT	0.41416	34.94078	0.41416	44.74	0.03554	2.99828	0.03554	80	2.73004	145.22000	2.73004
ST.(SAFETY GLASS)UNPNT INT	CT	0.76335	38.14326	0.76335	56.20	0.06550	3.27309	0.06550	80	2.73004	220.48000	2.73004
ST.SLIDING UNPNTD.INT.DOOR	CT	0.58793	75.78039	0.58793	89.69	0.05045	6.50274	0.05045	80	2.73004	844.82000	2.73004
ST.(INSUL.CORE)UNPNTD.INT.	CT	0.76335	36.92675	0.76335	54.99	0.06550	3.16870	0.06550	80	2.73004	285.14000	2.73004
AL.(PLAIN & ANODIZED)INT.	CT	0.68468	57.76311	0.68468	73.96	0.05875	4.95668	0.05875	65	2.73004	265.00000	2.73004
AL.(P&L)(SAFETY GLASS) FR.	CT	1.03387	60.96559	1.03387	85.43	0.08872	5.23148	0.08872	65	2.73004	327.16052	2.73004
AL. SLIDING INTERIOR DOOR	CT	1.32113	127.36590	1.32113	158.62	0.11337	10.92932	0.11337	65	2.73004	848.00000	2.73004
AL.(WOOD CORE) INT. DOOR	CT	1.03387	59.74908	1.03387	84.21	0.08872	5.12709	0.08872	65	2.73004	385.84000	2.73004
AL.(INSUL.)P&A INT. DOOR	CT	1.03387	59.74908	1.03387	84.21	0.08872	5.12709	0.08872	65	2.73004	383.72000	2.73004
FULLY GLAZED DOORS												
FULLY GLAZED AL. FR. DOOR	CT	1.03387	81.62793	1.03387	106.09	0.08872	7.00452	0.08872	65	2.73004	395.38000	2.73004
FULLY GLAZED AL.FP. SLID.	CT	1.32113	142.44909	1.32113	173.71	0.11337	12.22361	0.11337	65	5.63216	636.00000	2.81608
FULLY GLAZED WOODEN FR. DR	CT	1.59877	98.63971	1.59877	136.47	0.13719	8.46431	0.13719	50	2.89680	123.04480	2.89680
GLAZED WOOD FR.SLIDING INT	CT	1.94232	164.54984	1.94232	210.51	0.16667	14.12009	0.16667	50	5.79892	460.12480	2.98284
WOOD DOORS												
HOLLOW CORE INT.PNTD. DOOR	CT	3.75737	120.36232	3.75737	209.26	0.32242	10.32834	0.32242	30	3.67727	184.10080	3.67727
HOLLOW CORE SLIDING INT.	CT	2.49721	126.11282	2.49721	185.20	0.21429	10.82179	0.21429	30	6.05336	158.78800	3.23728
SOLID CORE INT. PNTD. DOOR	CT	3.16870	70.69920	3.16870	145.67	0.27191	6.06673	0.27191	40	3.67727	186.22080	3.67727
SOLID CORE SLIDING INT. DR	CT	1.88200	126.44710	1.88200	170.98	0.16150	10.85048	0.16150	40	6.05336	269.02800	3.23728
SOLID CORE(SAF GLASS)PNTD	CT	1.90691	73.90168	1.90691	119.02	0.16363	6.34153	0.16363	40	5.95573	221.88132	5.95573
BIFOLD DOORS												
PANELED	CT	0.80535	30.31973	0.80535	49.37	0.06482	2.51928	0.06482	24	4.87323	52.57600	4.87323
REPLACE PANELED (PAINTED) INTERIOR DOORS									24	4.61968	47.70000	4.61968
LOUVERED	CT	1.83935	23.06788	1.83935	66.59	0.15140	1.86831	0.15140	24	5.00001	86.07200	5.00001
REPLACE LOUVERED (PAINTED) INTERIOR DOORS									24	4.61968	79.50000	4.61968
AL. LOUVERED INTERIOR DOOR	CT	2.65389	84.62262	2.65389	147.41	0.22773	7.26150	0.22773	65	6.04897	508.46080	6.04897
STEEL LOUVERED INT. DOOR	CT	2.02925	54.17387	2.02925	102.19	0.17413	4.64868	0.17413	80	6.04897	310.77080	3.23289
WOOD LOUVERED INT. DOOR	CT	5.02669	217.62187	5.02669	336.55	0.43134	18.67422	0.43134	40	6.04897	311.30080	6.04897
STEEL VAULT DOOR	CT	0.41416	34.94078	0.41416	44.74	0.03554	2.99828	0.03554	300	69.32900	32860.00000	23.10967
METAL WALK-IN-COOLER DOOR	CT	0.41416	34.94078	0.41416	44.33	0.03554	2.99828	0.03554	70	40.40400	649.25000	13.46800
LEAD-LINED(WOOD) MEDICAL	CT	0.89689	75.66598	0.89689	96.01	0.07696	6.49293	0.07696	80	2.73004	510.92000	2.73004
METAL WIRE MESH PNTD. INT	CT	2.33091	10.10866	2.33091	65.26	0.20002	0.86743	0.20002	150	7.33475	202.12080	4.10780
METAL WIRE MESH PNTD. INT	CT	0.05557	0.03250	0.05557	1.35	0.00477	0.00279	0.00477	150	6.45389	198.22000	3.22695
GARAGE & ROLL-UP DOORS												
STEEL SINGLE ROLL-UP DOOR	CT	5.96581	265.55005	5.96581	406.70	0.51193	22.78695	0.51193	35	4.84587	176.32040	2.67316
STEEL DOUBLE ROLL-UP DOOR	CT	11.56755	392.38200	11.56755	666.07	0.99262	33.67045	0.99262	35	5.38802	445.73000	3.21531
AL. SINGLE ROLL-UP DOOR	CT	5.66990	246.88918	5.66990	381.04	0.47807	21.11681	0.47807	24	4.84587	135.24540	2.67316
REPLACE ALUMINUM SINGLE ROLL-UP DOOR									24	4.34542	131.17500	2.17271
AL. DOUBLE ROLL-UP DOOR	CT	10.95106	289.84354	10.95106	548.95	0.92208	24.72816	0.92208	24	5.38802	478.85500	3.21531
REPLACE ALUMINUM DOUBLE ROLL-UP DOOR INTER									24	4.34542	470.37500	2.17271
WOOD SINGLE ROLL-UP DOOR	CT	5.47017	284.84902	5.47017	414.27	0.45485	24.32470	0.45485	16	4.84587	239.92040	2.67316
REPLACE WOOD SINGLE ROLL-UP DOOR									16	4.34542	235.85000	2.17271
WOOD DOUBLE ROLL-UP DOOR	CT	8.77279	403.37982	8.77279	610.94	0.72249	34.36772	0.72249	16	5.38802	538.48000	3.21531
REPLACE WOOD DOUBLE ROLL-UP DOOR									16	4.34542	530.00000	2.17271
FIREPLACE												
CHIMNEY												

See NOTES on the last page of this table for Explanation of Column Headings

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION		PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%)				ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS						
		By Resources			Washington	Annual Maintenance and Repair			Replacement and High Costs Tasks			
	um	labor	material	equipment	D.C. Total	labor	material	equipment	yr	labor	material	equipment
CLAY BRICK	SF	0.00527	0.00441	0.00527	0.13	0.00045	0.00038	0.00045	500	1.34004	4.87600	0.67002
CONCRETE BRICK	SF	0.00527	0.00543	0.00527	0.13	0.00045	0.00047	0.00045	500	1.34004	1.66547	0.67002
STONE	SF	0.00134	0.00664	0.00134	0.04	0.00012	0.00057	0.00012	500	0.34931	1.99386	0.17466
METAL PIPE CHIMNEY	SF	0.00386	0.22118	0.00386	0.31	0.00033	0.01898	0.00033	200	1.82390	4.67248	0.91195
MANTEL												
WOOD	LF	0.02419	0.11170	0.02419	0.68	0.00208	0.00959	0.00208	200	0.58058	0.72080	0.29822
CONCRETE	LF	0.01528	0.01063	0.01528	0.37	0.00131	0.00091	0.00131	300	0.18616	19.61000	0.09308
STONE	LF	0.00094	0.00931	0.00094	0.03	0.00008	0.00080	0.00008	300	0.18616	1.80200	0.09308
FINISH												
BRICK	SF	0.01860	0.09031	0.01860	0.53	0.00160	0.00775	0.00160	300	1.08828	1.30380	0.54989
CONCRETE BLOCK	SF	0.01860	0.46079	0.01860	0.90	0.00160	0.03954	0.00160	300	1.08828	1.55820	0.54989
PLASTER	SF	0.01398	0.09981	0.01398	0.43	0.00120	0.00856	0.00120	100	0.23680	0.96460	0.23680
WOOD	SF	0.01393	0.08562	0.01393	0.42	0.00120	0.00735	0.00120	100	0.29517	0.92220	0.15269
FIREBRICK												
FIRE BRICK	SF	0.00554	0.00515	0.00554	0.14	0.00048	0.00044	0.00048	300	1.07679	0.99640	0.53840
FLUES ARCHITECTURAL												
BAKED CLAY FLUE, ARCH.	LF	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	400	1.34004	4.73502	0.67002
METAL PIPE FLUE, ARCH.	LF	0.00386	0.16261	0.00386	0.25	0.00033	0.01395	0.00033	200	1.82390	3.61248	0.91195
INTERIOR ORNAMENT												
INTERIOR TRIM												
WOOD	LF	0.01211	0.08658	0.01211	0.37	0.00104	0.00743	0.00104	100	0.04778	0.85860	0.02899
METAL	LF	0.01377	0.11324	0.01377	0.44	0.00118	0.00972	0.00118	200	0.04980	1.01760	0.04980
TERRAZZO TRIM	LF	0.00642	0.01921	0.00642	0.17	0.00055	0.00165	0.00055	75	0.79888	2.65000	0.39944
CERAMIC TRIM	LF	0.00642	0.00945	0.00642	0.16	0.00055	0.00081	0.00055	50	0.79888	1.30380	0.39944
RUBBER / VINYL TRIM	LF	0.00877	0.20161	0.00456	0.40	0.00003	0.00061	0.00003	18	0.02847	0.65720	0.01424
INTERIOR STAIRS												
RAILINGS												
WOOD	LF	0.02265	0.20010	0.02265	0.74	0.00194	0.01717	0.00194	100	0.16835	3.87536	0.09210
METAL	LF	0.03769	0.15401	0.03769	1.05	0.00323	0.01322	0.00323	300	1.48174	1.84016	0.75160
IRON INT. STAIR .ILING	LF	0.07955	0.18878	0.07955	2.07	0.00683	0.01620	0.00683	200	2.18088	27.11480	1.10968
STEPS												
CONCRETE	SF	0.01475	0.01490	0.01475	0.36	0.00127	0.00128	0.00127	300	2.93605	16.84340	1.46803
WOOD	SF	0.02624	0.13673	0.02624	0.76	0.00225	0.01173	0.00225	100	0.46410	3.68456	0.23998
METAL	SF	0.02230	0.32536	0.02230	0.85	0.00191	0.02792	0.00191	300	2.16216	35.06480	1.09181
MASONRY STEPS (UNPNTD)	SF	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	400	1.59777	2.23660	0.79888
MASONRY STEPS (PAINTED)	SF	0.02669	0.07963	0.02669	0.71	0.00229	0.00683	0.00229	400	1.61909	2.30020	0.82020
CARPETED STEPS	SF	0.07037	6.11689	0.04109	7.69	0.00101	0.01042	0.00101	8	0.05239	5.36360	0.02620
RUBBER INTERIOR STEPS	SF	0.11515	2.50392	0.05892	5.05	0.00023	0.00762	0.00023	18	0.38007	8.16200	0.19003
TERRAZZO INTERIOR STEPS	SF	0.01158	0.03265	0.01158	0.31	0.00099	0.00280	0.00099	300	1.59774	4.50500	0.79887
INTERIOR HARDWARE												
HINGES												
BRASS	CT	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	60	0.21151	19.08000	0.21151
LOCKSET												
BRASS	CT	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	30	1.64840	124.02000	1.64840
DOOR CLOSER												
BRASS	CT	0.17907	32.65224	0.17907	36.89	0.00000	0.00000	0.00000	15	0.49413	90.10000	0.49413
DEADBOLT												
BRASS	CT	0.24274	20.54280	0.24274	26.29	0.00000	0.00000	0.00000	20	0.93938	79.50000	0.93938
WEATHER STRIPING												
BRASS	CT	0.17213	6.84760	0.17213	10.92	0.00000	0.00000	0.00000	20	0.66612	26.50000	0.66612
EXIT BOLT												
METAL	CT	0.37940	78.10080	0.37940	87.08	0.00000	0.00000	0.00000	25	2.05972	424.00000	2.05972

See NOTES on the last page of this table for Explanation of Column Headings

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%) By Resources labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS Annual Maintenance and Repair labor	material	equipment	Replacement and High Costs Tasks yr	labor	material	equipment
ARCHITECTURE												
WALL FINISHES												
GYPSUM AND PLASTER												
PLASTER	SF	0.05009	0.22521	0.05009	1.41	0.00430	0.01933	0.00430	300	0.23335	2.29278	0.12597
SHEETROCK (STIPPLED)	SF	0.04511	0.20226	0.04511	1.27	0.00387	0.01736	0.00387	300	0.03549	0.41976	0.02704
SHEETROCK (UNSTIPPLED)	SF	0.04511	0.20173	0.04511	1.27	0.00387	0.01731	0.00387	300	0.03497	0.31376	0.02678
STUCCO INT. WALL FINISH	SF	0.10947	0.25086	0.10947	2.84	0.00939	0.02153	0.00939	300	0.27846	0.95400	0.15750
MASONRY AND TILE												
CLAY BLOCK	SF	0.00117	0.03538	0.00117	0.06	0.00010	0.00304	0.00010	500	0.20150	9.60360	0.10075
CLAY BLOCK (PAINTED)	SF	0.04483	0.23575	0.04483	1.30	0.00385	0.02023	0.00385	500	0.22009	9.67356	0.11934
CONCRETE BLOCK	SF	0.00117	0.00293	0.00117	0.03	0.00010	0.00025	0.00010	500	0.20150	0.84376	0.10075
CONCRETE BLOCK (PAINTED)	SF	0.04483	0.20330	0.04483	1.26	0.00385	0.01744	0.00385	500	0.22009	0.91372	0.11934
CLAY BRICK	SF	0.00453	0.00449	0.00453	0.11	0.00039	0.00039	0.00039	500	1.09213	1.21900	0.54607
CONCRETE BRICK	SF	0.00445	0.00543	0.00445	0.11	0.00038	0.00047	0.00038	500	1.09213	1.47340	0.54607
FIRE BRICK	SF	0.00445	0.00367	0.00445	0.11	0.00038	0.00031	0.00038	500	1.09200	0.99640	0.54600
TILE	SF	0.02043	0.01983	0.02043	0.50	0.00175	0.00170	0.00175	100	1.21342	1.29320	1.21342
MASONITE INT. WALL FINISH	SF	0.09045	0.25466	0.09045	2.39	0.00776	0.02185	0.00776	200	0.08726	0.62540	0.08726
GLAZED CMU INT WALL FINISH	SF	0.00117	0.01982	0.00117	0.05	0.00010	0.00170	0.00010	500	0.20150	5.38056	0.10075
PAPER,PLASTIC,FABRIC												
FORMICA	SF	0.00239	0.06502	0.00239	0.12	0.00021	0.00558	0.00021	30	0.02925	4.24000	0.01463
NYLON	SF	0.00239	0.01625	0.00239	0.07	0.00021	0.00139	0.00021	30	0.02925	1.06000	0.02925
POLYESTER	SF	0.00239	0.00943	0.00239	0.07	0.00021	0.00081	0.00021	30	0.02925	0.61480	0.02925
VINYL	SF	0.00229	0.00975	0.00229	0.06	0.00020	0.00084	0.00020	30	0.02925	0.63600	0.02925
WALLPAPER	SF	0.01031	0.11737	0.01031	0.36	0.00024	0.00067	0.00024	20	0.02925	0.42400	0.02925
FABRIC INT. WALL FINISH	SF	0.01031	0.31103	0.01031	0.55	0.00024	0.00178	0.00024	20	0.02925	1.12360	0.02925
CARPETED INT. WALL FINISH	SF	0.09108	2.21770	0.05345	4.25	0.00136	0.01136	0.00136	8	0.06734	1.86560	0.03367
WOODS												
PLYWOOD	SF	0.03843	0.17417	0.03843	1.08	0.00330	0.01495	0.00330	80	0.04758	0.88616	0.03309
PLYWOOD (UNFINISHED)	SF	0.00229	0.01252	0.00229	0.07	0.00020	0.00107	0.00020	60	0.02899	0.81620	0.01450
TIMBER (FINISHED)	SF	0.04262	0.17417	0.04262	1.18	0.00366	0.01495	0.00366	80	0.31889	0.88616	0.16874
TIMBER (UNFINISHED)	SF	0.00648	0.01252	0.00648	0.17	0.00056	0.00107	0.00056	70	0.30030	0.81620	0.15015
PANEL (SOLID)	SF	0.03626	0.16256	0.03626	1.02	0.00311	0.01395	0.00311	200	0.42406	0.53636	0.22133
PANEL (LAMINATED)	SF	0.03626	0.16185	0.03626	1.02	0.00311	0.01389	0.00311	200	0.42406	0.34556	0.22133
BOARD (FINISHED)	SF	0.03487	0.16174	0.03487	0.99	0.00299	0.01388	0.00299	80	0.04758	0.31376	0.03309
BOARD (UNFINISHED)	SF	0.00057	0.00090	0.00057	0.01	0.00005	0.00008	0.00005	60	0.02899	0.24380	0.01450
WAINSCOT	SF	0.04555	0.20229	0.04555	1.28	0.00391	0.01736	0.00391	80	0.22742	2.71996	0.12374
METAL												
ALUMINUM	SF	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	100	0.07319	1.92920	0.03660
STEEL INT. FINISH (UNPNTD)	SF	0.00200	0.02181	0.00200	0.07	0.00017	0.00187	0.00017	200	0.56936	5.53320	0.28468
STEEL INT. FINISH (PNTD)	SF	0.38391	8.67141	0.38391	17.75	0.03294	0.74410	0.03294	200	0.57070	6.27520	0.30173
WIRE MESH WALL	SF	0.32556	0.75856	0.32556	8.46	0.02794	0.06509	0.02794	200	0.07609	3.37080	0.05069
LEAD-LINED INT WALL FINISH	SF	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	100	2.20662	12.61400	1.10331
GLASS												
GLASS BLOCKS	SF	0.00426	0.04463	0.00426	0.15	0.00037	0.00383	0.00037	300	1.04013	12.11580	0.52007
PLATE GLASS WALL - INT.	SF	0.00141	0.03343	0.00141	0.07	0.00012	0.00287	0.00012	200	0.09906	8.48000	0.04953
SPECIAL												
STONE	SF	0.00117	0.00664	0.00117	0.03	0.00010	0.00057	0.00010	500	0.20150	1.80200	0.10075
ACOUSTICAL TILE WALL	SF	0.25031	0.74314	0.25031	6.67	0.02148	0.06377	0.02148	90	0.37141	0.54060	0.19637
CORK TILE WALL	SF	0.12610	0.89378	0.06675	3.69	0.00063	0.00337	0.00063	16	0.35048	2.52280	0.17524
ASB.-ACOS FIRE RTD. TILE	SF	0.06398	0.18767	0.06398	1.70	0.00549	0.01610	0.00549	90	0.37141	0.64660	0.19637
FIBERGLASS PANELS, RIGID	SF	0.09130	0.27518	0.09130	2.44	0.00783	0.02361	0.00783	70	0.06540	1.77285	0.04750
CONCRETE												
UNFINISHED	SF	0.01691	0.00917	0.01691	0.41	0.00145	0.00079	0.00145	500	3.80861	4.63220	1.90431
CONCRETE (FINISHED)	SF	0.05910	0.20928	0.05910	1.61	0.00507	0.01796	0.00507	500	3.80861	4.63220	1.90431
FLOORING/FLOOR FINISH												
MASONRY & TILE PRODUCTS												
CERAMIC TILE	SF	0.00014	0.00019	0.00014	0.00	0.00001	0.00002	0.00001	50	0.18247	2.00340	0.18247
QUARRY TILE	SF	0.00014	0.00019	0.00014	0.00	0.00001	0.00002	0.00001	50	0.90337	1.72780	0.45169

See NOTES on the last page of this table for Explanation of Column Headings

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%) By Resources labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS Annual Maintenance and Repair labor	material	equipment	Replacement and High Costs Tasks yr	labor	material	equipment
BRICK	SF	0.00603	0.02125	0.00603	0.16	0.00052	0.00182	0.00052	60	0.43604	2.65731	0.21802
MARBLE	SF	0.00030	0.00041	0.00030	0.01	0.00003	0.00003	0.00003	50	0.90337	7.52600	0.45169
WOODS												
WOOD PARQUETRY	SF	0.01731	0.11204	0.01731	0.52	0.00149	0.00961	0.00149	40	0.19980	2.12000	0.09990
MAPLE	SF	0.01501	0.11354	0.01501	0.47	0.00129	0.00974	0.00129	40	0.03804	2.19420	0.01902
PLYWOOD	SF	0.00211	0.00795	0.00211	0.06	0.00018	0.00068	0.00018	40	0.02054	0.39220	0.01027
METAL												
STEEL SHEET	SF	0.00282	0.24381	0.00282	0.31	0.00024	0.02092	0.00024	30	1.93258	3.28600	0.96629
METAL GRATING	SF	0.00282	0.24381	0.00282	0.31	0.00024	0.02092	0.00024	30	1.93258	3.24360	0.96629
SPECIAL SURFACES												
CARPET	SF	0.05851	2.11270	0.02944	3.40	0.00003	0.00235	0.00003	8	0.05200	1.86560	0.02600
CORK FLOOR TILE	SF	0.01127	0.55092	0.00579	0.80	0.00003	0.00106	0.00003	16	0.03237	1.59000	0.01619
SYNTHETIC SURFACE												
LINOLEUM	SF	0.00916	0.75064	0.00476	0.95	0.00003	0.00116	0.00003	18	0.02977	2.49100	0.01489
VINYL TILE	SF	0.00986	0.41525	0.00507	0.63	0.00002	0.00064	0.00002	18	0.03237	1.37800	0.01619
RUBBER TILE	SF	0.00986	1.19463	0.00986	1.43	0.00002	0.00185	0.00002	18	0.03237	3.96440	0.03237
VINYL SHEET	SF	0.11515	0.75012	0.05892	3.29	0.00023	0.00112	0.00023	18	0.38007	2.49100	0.19003
CONCRETE												
CONCRETE (UNFINISHED)	SF	0.00311	0.00183	0.00311	0.08	0.00027	0.00016	0.00027	75	0.09425	0.50562	0.04713
CONCRETE (FINISHED)	SF	0.00421	0.14241	0.00366	0.24	0.00036	0.01222	0.00031	75	0.09841	0.50562	0.04921
TERRAZZO												
TERRAZZO, PRECAST	SF	0.00311	0.01921	0.00311	0.09	0.00027	0.00165	0.00027	75	0.09841	5.30000	0.04921
BITUMINOUS												
BITUMINOUS	SF	0.06122	0.23160	0.03164	1.59	0.00018	0.00043	0.00018	15	0.16324	0.62540	0.08162
CEILINGS												
GYPSUM AND PLASTER												
PLASTER	SF	0.04920	0.22597	0.04920	1.39	0.00422	0.01939	0.00422	300	0.23335	2.35638	0.12597
SHEETROCK (STIPPLED)	SF	0.04511	0.20262	0.04511	1.27	0.00387	0.01739	0.00387	300	0.03549	0.48972	0.02704
SHEETROCK (UNSTIPPLED)	SF	0.04511	0.20209	0.04511	1.27	0.00387	0.01734	0.00387	300	0.03497	0.38372	0.02678
STUCCO INT. CEILING FINISH	SF	0.10947	0.25086	0.10947	2.84	0.00939	0.02153	0.00939	300	0.27846	0.95400	0.15750
MASONRY AND TILE												
ACOUSTIC TILE	SF	0.00764	0.01994	0.00764	0.20	0.00066	0.00171	0.00066	70	0.02340	1.12095	0.01170
ACOUSTIC TILE (DROPPED)	SF	0.00217	0.01219	0.00217	0.06	0.00019	0.00105	0.00019	70	0.00754	1.42040	0.00377
CERAMIC (PAN)	SF	0.00113	0.00019	0.00113	0.00	0.00010	0.00002	0.00010	100	3.90988	1.72780	1.95494
CERAMIC (TILE)	SF	0.00113	0.00192	0.00113	0.01	0.00010	0.00016	0.00010	100	3.90988	2.00340	1.95494
PAPER, PLASTIC, FABRIC												
PAPER	SF	0.01031	0.11737	0.01031	0.36	0.00024	0.00067	0.00024	20	0.02925	0.42400	0.02925
PLASTIC	SF	0.00229	0.00975	0.00229	0.06	0.00020	0.00084	0.00020	30	0.02925	0.63600	0.02925
FABRIC	SF	0.00229	0.00943	0.00229	0.06	0.00020	0.00081	0.00020	30	0.02925	0.61480	0.02925
FORMICA CEILING FINISH	SF	0.00229	0.06502	0.00229	0.12	0.00020	0.00558	0.00020	30	0.02925	4.24000	0.02925
WOODS												
WOOD (FINISHED)	SF	0.03868	0.04210	0.03868	0.96	0.00332	0.00361	0.00332	80	0.31889	0.94976	0.16874
WOOD (UNFINISHED)	SF	0.00648	0.01252	0.00648	0.17	0.00056	0.00107	0.00056	60	0.30030	0.81620	0.30030
METALS												
ALUMINIUM PANELS	SF	0.06655	0.91965	0.06655	2.49	0.00571	0.07892	0.00571	100	0.06565	3.08460	0.03536
METAL INT. FINISH (UNPNTD)	SF	0.00200	0.02181	0.00200	0.07	0.00017	0.00187	0.00017	200	0.57473	5.53320	0.28737
GLASS												
PLATE GLASS (MOUNTED)	SF	0.00132	0.03999	0.00066	0.07	0.00011	0.00343	0.00006	60	0.09906	10.85440	0.04953
PLATE GLASS (SUSPENDED)	SF	0.00453	0.34806	0.00227	0.45	0.00039	0.02987	0.00019	60	0.02015	10.85440	0.01008
SINGLE UNIT GLASS SKYLIGHT	SF	0.03754	0.62881	0.03754	1.52	0.00322	0.05396	0.00322	300	0.17978	19.61000	0.08989
SINGLE UNIT GLASS SKYLIGHT	SF	0.03735	0.52684	0.03735	1.41	0.00321	0.04521	0.00321	300	1.22586	16.43000	0.61293
SPECIAL SURFACES												
ACOUSTIC TILE SPECIAL PUR.	SF	0.00217	0.01869	0.00217	0.07	0.00019	0.00160	0.00019	65	0.00754	1.84440	0.00377
ACOUSTIC TILE (FIRE RATED)	SF	0.00217	0.01783	0.00217	0.07	0.00019	0.00153	0.00019	65	0.00754	1.79140	0.00377
ASB.-ACOS. FIRE RTD. TILE	SF	0.06398	0.18767	0.06398	1.70	0.00549	0.01610	0.00549	65	0.37141	0.64660	0.19637
FIBERGLASS PANELS, RIGID	SF	0.09130	0.27518	0.09130	2.44	0.00783	0.02361	0.00783	70	0.06536	1.77285	0.04748
CONCRETE												
CONCRETE (UNFINISHED)	SF	0.00311	0.00183	0.00311	0.08	0.00027	0.00016	0.00027	500	3.80861	4.63220	1.90431

See NOTES on the last page of this table for Explanation of Column Headings

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION		PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d= 7%)				ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS						
		By Resources			Washington	Annual Maintenance and Repair			Replacement and High Costs Tasks			
	um	labor	material	equipment	D.C. Total	labor	material	equipment	yr	labor	material	equipment
CONCRETE (FINISHED)	SF	0.00421	0.14241	0.00366	0.24	0.00036	0.01222	0.00031	500	3.80861	4.63220	1.90431

See NOTES on the last page of this table for Explanation of Column Headings

Notes

1. The resources listed in this table are as of the Date of Study (DOS) and have been calculated using a present worth discount factor (d) of 7 percent. The Date of Study (DOS) is the Beneficial Occupancy Date (BOD). All tasks are assumed to occur at the end of the year. All resources have been assumed to be constant with no differential escalation from year to year.

2 Component Description - This column contains an indented list of systems, subsystems, components, and high cost task descriptions.

3. Unit of Measure (UM) - This column contains a two-character code to indicate the measurement unit for the component. Units used in this column are as follows:

CT	Count
LF	Linear Foot
SF	Square Foot
TF	Thousands of Linear Feet

4. Labor - Labor resources can be used in one of two ways: (1) labor hours per unit of measure, or (2) dollars per unit of measure assuming a $1.00/hr labor rate.

5. Materials - Material resources are expressed in dollars per unit of measure in July 1988 dollars for the Washington, DC, area.

6. Equipment - Equipment resources can be used in one of two ways: (1) equipment hours per unit of measure, or (2) dollars per unit of measure assuming a $1.00/hr equipment rate.

7. Washington, DC, Total - The dollars per unit of measure figures were calculated by applying the Military District of Washington labor and equipment rates to the labor and equipment resources, then adding the labor, material, and equipment costs together to form one total cost figure.

8. Year (YR) - This column contains the average age of the component when the high cost task or replacement task would be performed.

9 Engineered Performance Standards (EPS) - Most labor and equipment resource data is based on the DOD series of Technical Bulletins as discussed in the body of the report.

APPENDIX B:

LIFE-CYCLE COST ANALYSIS TABLE (10 PERCENT)

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%) By Resources: labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS Annual Maintenance and Repair: labor	material	equipment	Replacement and High Costs Tasks: yr	labor	material	equipment
ARCHITECTURE												
ROOFING												
ROOF COVERING												
BUILTUP ROOFING	SF	0.03987	0.37166	0.01994	1.25	0.00487	0.03167	0.00244	28	0.04938	0.70490	0.02469
PLACE NEW MEMBRANE OVER EXISTING -BUILTUP									14	0.02414	0.69960	0.01207
MOD.BIT./THERMOPLASTIC	SF	0.02415	0.33069	0.01208	0.86	0.00245	0.03218	0.00123	20	0.05659	0.85860	0.02829
THERMOSETTING	SF	0.01667	0.23941	0.00833	0.61	0.00173	0.02202	0.00086	20	0.03683	0.69960	0.01841
SLATE	SF	0.01809	0.10432	0.00904	0.50	0.00253	0.01458	0.00126	70	0.06885	6.04200	0.03442
CEMENT ASBESTOS	SF	0.01760	0.24341	0.00881	0.63	0.00246	0.03403	0.00123	70	0.05437	0.75190	0.02718
TILE	SF	0.01519	0.20982	0.00759	0.54	0.00212	0.02933	0.00106	70	0.10169	3.07400	0.05084
ROLL ROOFING	SF	0.07156	0.42684	0.03578	2.01	0.00757	0.01556	0.00378	10	0.04141	0.74963	0.02070
SHINGLES	SF	0.02222	0.22132	0.01111	0.71	0.00262	0.02383	0.00131	40	0.04118	0.74497	0.02059
REPLACE NEW OVER EXISTING - SHINGLED ROOF									20	0.02996	0.43460	0.01498
METAL	SF	0.01422	0.11058	0.00711	0.42	0.00199	0.01546	0.00099	30	0.36265	2.17300	0.18132
FIBERGLASS RIGID STP. ROOF	SF	0.02161	1.15262	0.01080	1.63	0.00228	0.06266	0.00114	20	0.04543	6.01550	0.02272
CONCRETE,SEALED PANEL ROOF	SF	0.04260	0.11748	0.02131	1.06	0.00596	0.01642	0.00298	60	0.06123	24.07419	0.03061
CONCRETE,SEALED PANEL RF4	SF	0.03950	0.08408	0.01974	0.96	0.00552	0.01175	0.00276	300	0.04342	24.07419	0.02171
CONCRETE SEALED POURED	SF	0.09872	0.62996	0.04936	2.81	0.01380	0.08807	0.00690	500	3.81056	18.03219	1.90528
FIBERGLASS, RIGID ROOF	SF	0.03832	1.15262	0.01915	2.00	0.00468	0.06266	0.00234	20	0.04133	6.01550	0.02066

See NOTES on the last page of this table for Explanation of Column Headings

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%) — By Resources: labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS — Annual Maintenance and Repair: labor	material	equipment	Replacement and High Costs Tasks: yr	labor	material	equipment
ARCHITECTURE												
EXTERIOR WALL												
EXTERIOR FINISHES												
ADOBE First Floor	SF	0.03561	0.39957	0.03561	1.24	0.00498	0.05586	0.00498	300	1.10968	2.18360	0.56362
ADOBE Second Floor	SF	0.07430	0.39957	0.07430	2.16	0.01039	0.05586	0.01039	300	1.24670	2.18360	0.63954
ADOBE Third Floor	SF	0.10262	0.39957	0.10262	2.83	0.01435	0.05586	0.01435	300	1.38333	2.18360	0.71513
CLAY BRICK First Floor	SF	0.00176	0.00177	0.00176	0.04	0.00025	0.00025	0.00025	500	1.09213	1.21900	0.54607
CLAY BRICK Second Floor	SF	0.00300	0.00177	0.00300	0.07	0.00042	0.00025	0.00042	500	1.21433	1.21900	0.60717
CLAY BRICK Third Floor	SF	0.00370	0.00177	0.00370	0.09	0.00052	0.00025	0.00052	500	1.33640	1.21900	0.66820
CLAY BRICK (WP/P) 1st Flr.	SF	0.01972	0.04127	0.01972	0.51	0.00031	0.00027	0.00031	500	1.12866	1.30380	0.58260
REFINISH PAINTED CLAY BRICK EXT. WALL - 1S									8	0.02825	0.06360	0.02825
CLAY BRICK (WP/P) 2nd Flr.	SF	0.03164	0.04127	0.03164	0.79	0.00060	0.00027	0.00060	500	1.26750	1.30380	0.66034
REFINISH PAINTED CLAY BRICK EXT.WALL - 2ND									8	0.04417	0.06360	0.04417
CLAY BRICK (WP/P) 3rd Flr.	SF	0.04260	0.04127	0.04260	1.05	0.00079	0.00027	0.00079	500	1.40608	1.30380	0.73788
REFINISH PAINTED CLAY BRICK EXT.WALL - 3RD									8	0.05969	0.06360	0.05969
CONCRETE BRICK 1st Floor	SF	0.00176	0.00214	0.00176	0.04	0.00025	0.00030	0.00025	500	1.09213	1.47340	0.54607
CONCRETE BRICK 2nd Floor	SF	0.00360	0.00214	0.00300	0.07	0.00042	0.00030	0.00042	500	1.21420	1.47340	0.60710
CONCRETE BRICK 3rd Floor	SF	0.00373	0.00214	0.00373	0.09	0.00052	0.00030	0.00052	500	1.33640	1.47340	0.66820
CONCRETE BRICK (WP/P) 1 Fl	SF	0.01948	0.04164	0.01948	0.50	0.00028	0.00032	0.00028	500	1.12866	1.55820	0.58260
REFINISH EXTERIOR WALL - 1ST FLOOR									8	0.02825	0.06360	0.02825
CONCRETE BRICK (WP/P) 2 Fl	SF	0.03165	0.04164	0.03165	0.79	0.00060	0.00032	0.00060	500	1.26750	1.55820	0.66034
REFINISH PAINTED CONCRETE BRICK EXT.WALL-2									8	0.04417	0.06360	0.04417
CONCRETE BRICK (WP/P) 3 Fl	SF	0.04260	0.04164	0.04260	1.05	0.00079	0.00032	0.00079	500	1.40608	1.55820	0.73788
REFIN.PAINTED CONC.BRICK EXT.WALL - 3RD FL									8	0.05969	0.06360	0.05969
STRUCTURAL CLAY TILE 1 Flr	SF	0.00047	0.01396	0.00047	0.03	0.00007	0.00195	0.00007	500	0.20150	9.60360	0.10075
STRUCTURAL CLAY TILE 2 Flr	SF	0.00156	0.01396	0.00156	0.05	0.00022	0.00195	0.00022	500	0.23465	9.60360	0.11733
STRUCTURAL CLAY TILE 3 Flr	SF	0.00218	0.01396	0.00218	0.07	0.00031	0.00195	0.00031	500	0.26767	9.60360	0.13384
STRUC. CLAY TILE WP/P 1 Fl	SF	0.01818	0.05346	0.01818	0.48	0.00010	0.00197	0.00010	500	0.23803	9.68840	0.13728
REFINISH PAINTED STRUCT.CLAY TILE EXT.WALL									8	0.02825	0.06360	0.02825
STRUC. CLAY TILE WP/P 2 Fl	SF	0.03021	0.05346	0.03021	0.77	0.00040	0.00197	0.00040	500	0.28782	9.68840	0.17050
REFINISH PAINTED STRUCT.CLAY TILE EXT.WALL									8	0.04417	0.06360	0.04417
STRUC. CLAY TILE WP/P 3 Fl	SF	0.04105	0.05346	0.04105	1.02	0.00057	0.00197	0.00057	500	0.33735	9.68840	0.20352
REFINISH PAINTED STRUCT.CLAY TILE EXT.WALL									8	0.05969	0.06360	0.05969
CONCRETE BLOCK First Floor	SF	0.00046	0.00123	0.00046	0.01	0.00006	0.00017	0.00006	500	0.20150	0.84376	0.10075
CONCRETE BLOCK Second Flr.	SF	0.00156	0.00123	0.00156	0.04	0.00022	0.00017	0.00022	500	0.23465	0.84376	0.11733
CONCRETE BLOCK Third Floor	SF	0.00218	0.00123	0.00218	0.05	0.00031	0.00017	0.00031	500	0.26767	0.84376	0.13384
CONCRETE BLOCK (WP/P) 1 Fl	SF	0.01819	0.04072	0.01819	0.47	0.00010	0.00019	0.00010	500	0.23803	0.92856	0.13728
REFINISH PAINTED CONCRETE BLOCK EXT.WALL -									8	0.02825	0.06360	0.02825
CONCRETE BLOCK (WP/P) 2 Fl	SF	0.03021	0.04072	0.03021	0.76	0.00040	0.00019	0.00040	500	0.28782	0.92856	0.17050
REFINISH PAINTED CONCRETE BLOCK EXT.WALL -									8	0.04417	0.06360	0.04417
CONCRETE BLOCK (WP/P) 3 Fl	SF	0.04105	0.04072	0.04105	1.01	0.00057	0.00019	0.00057	500	0.33735	0.92856	0.20352
REFINISH PAINTED CONCRETE BLOCK EXT.WALLS-									8	0.05969	0.06360	0.05969
CONCRETE (WP/P) First Flr.	SF	0.02112	0.04134	0.02112	0.54	0.00051	0.00027	0.00051	500	3.84605	4.71700	1.94129
REFINISH CONCRETE EXTERIOR WALL - 1ST FLOO									8	0.02825	0.06360	0.02825
CONCRETE (WP/P) Second Flr	SF	0.03343	0.04134	0.03343	0.83	0.00085	0.00027	0.00085	500	4.25568	4.71700	2.15443
REFINISH CONCRETE EXTERIOR WALL - 2ND FLOO									8	0.04417	0.06360	0.04417
CONCRETE (WP/P) Third Flr.	SF	0.04455	0.04134	0.04455	1.10	0.00106	0.00027	0.00106	500	4.66570	4.71700	2.36769
REFINISH CONCRETE EXTERIOR WALL - 3RD FLOO									8	0.05969	0.06360	0.05969
STONE First Floor	SF	0.00046	0.00262	0.00046	0.01	0.00006	0.00037	0.00006	500	0.20150	1.80200	0.10075
STONE Second Floor	SF	0.00156	0.00262	0.00156	0.04	0.00022	0.00037	0.00022	500	0.23465	1.80200	0.11733
STONE Third Floor	SF	0.00218	0.00262	0.00218	0.05	0.00031	0.00037	0.00031	500	0.26767	1.80200	0.13384
STUCCO First Floor	SF	0.01887	0.04769	0.01887	0.49	0.00019	0.00024	0.00019	300	0.27846	0.96460	0.15750
REFINISH STUCCO EXTERIOR WALL - 1ST FLOOR									8	0.02825	0.07420	0.02825
STUCCO Second Floor	SF	0.03217	0.04769	0.03217	0.81	0.00067	0.00024	0.00067	300	0.33241	0.96460	0.19279
REFINISH STUCCO EXTERIOR WALL - 2ND FLOOR									8	0.04417	0.07420	0.04417
STUCCO Third Floor	SF	0.04384	0.04769	0.04384	1.08	0.00096	0.00024	0.00096	300	0.40963	0.96460	0.23966
REFINISH STUCCO EXTERIOR WALL - 3RD FLOORS									8	0.05969	0.07420	0.05969
TERRACOTTA First Floor	SF	0.00069	0.00496	0.00069	0.02	0.00010	0.00069	0.00010	500	0.35009	3.41320	0.17505

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EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%) By Resources labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS Annual Maintenance and Repair labor	material	equipment	Replacement and High Costs Tasks yr	labor	material	equipment
TERRACOTTA Second Floor	SF	0.00181	0.00496	0.00181	0.05	0.00025	0.00069	0.00025	500	0.39819	3.41320	0.19910
TERRACOTTA Third Floor	SF	0.00244	0.00496	0.00244	0.06	0.00034	0.00069	0.00034	500	0.44928	3.41320	0.22464
WOOD, FINISHED 1 COAT 1 Fl	SF	0.03077	0.07585	0.03077	0.80	0.00012	0.00019	0.00012	125	0.33124	0.92220	0.18109
REFINISH WOOD FINISHED (S.CT) EXT.WALL - 1									5	0.02555	0.06360	0.02555
WOOD, FINISHED 1 COAT 2 Fl	SF	0.05128	0.07585	0.05128	1.29	0.00042	0.00019	0.00042	125	0.35893	0.92220	0.20150
REFINISH WOOD FINISHED (S.CT) EXT.WALL - 2									5	0.04119	0.06360	0.04119
WOOD, FINISHED 1 COAT 3 Fl	SF	0.07037	0.07585	0.07037	1.74	0.00059	0.00019	0.00059	125	0.44915	0.92220	0.25610
REFINISH WOOD FINISHED (S.CT) EXT.WALL -3R									5	0.05645	0.06360	0.05645
WOOD, FINISH MULTI-CT 1 Fl	SF	0.02018	0.06704	0.02018	0.54	0.00012	0.00020	0.00012	125	0.34502	0.97520	0.19487
REFINISH WOOD FINISHED (MULTI-CT) EXT.WALL									8	0.03120	0.10600	0.03120
WOOD, FINISH MULTI-CT 2 Fl	SF	0.03240	0.06704	0.03240	0.83	0.00043	0.00020	0.00043	125	0.37037	0.97520	0.21294
REFINISH WOOD FINISHED (MULTI-CT)EXT.WALL									8	0.04741	0.10600	0.04741
WOOD, FINISH MULTI-CT 3 Fl	SF	0.04343	0.06704	0.04343	1.09	0.00060	0.00020	0.00060	125	0.46592	0.97520	0.27287
REFINISH WOOD FINISHED (MULTI-CT) EXT.WALL									8	0.06323	0.10600	0.06323
WOOD SHAKES UNFINISH 1 Flr	SF	0.00112	0.00470	0.00112	0.03	0.00016	0.00066	0.00016	125	0.04355	0.71020	0.02178
WOOD SHAKES UNFINISH 2 Flr	SF	0.00598	0.00470	0.00598	0.15	0.00084	0.00066	0.00084	125	0.06097	0.71020	0.03049
WOOD SHAKES UNFINISH 3 Flr	SF	0.00865	0.00470	0.00865	0.21	0.00121	0.00066	0.00121	125	0.07813	0.71020	0.03907
WOOD SHAKES FINISHED 1 Flr	SF	0.03858	0.07991	0.03858	0.99	0.00031	0.00076	0.00031	125	0.07735	0.81620	0.05571
REFINISH WOOD SHAKES (FIN.) EXTERIOR WALL									5	0.03106	0.06360	0.03106
WOOD SHAKES FINISHED 2 Flr	SF	0.06731	0.07991	0.06731	1.67	0.00167	0.00076	0.00167	125	0.11154	0.81620	0.08106
REFINISH WOOD SHAKES (FIN.) EXTERIOR WALL									5	0.04728	0.06360	0.04728
WOOD SHAKES FINISHED 3 Flr	SF	0.09104	0.07991	0.09104	2.23	0.00241	0.00076	0.00241	125	0.14469	0.81620	0.10563
REFINISH WOOD SHAKES (FIN.)EXTERIOR WALL -									5	0.06298	0.06360	0.06298
ALUMINUM SIDING First Flr.	SF	0.02915	0.10047	0.02915	0.79	0.00408	0.01405	0.00408	80	0.09759	2.04580	0.06100
ALUMINUM SIDING Second Flr	SF	0.05688	0.10047	0.05688	1.45	0.00795	0.01405	0.00795	80	0.13334	2.04580	0.08660
ALUMINUM SIDING Third Flr.	SF	0.07991	0.10047	0.07991	1.99	0.01117	0.01405	0.01117	80	0.16869	2.04580	0.11188
ALUM. SIDING ANODIZED 1 Fl	SF	0.00055	0.00601	0.00055	0.02	0.00008	0.00084	0.00008	100	0.07319	2.12000	0.03660
ALUM. SIDING ANODIZED 2 Fl	SF	0.00265	0.00601	0.00265	0.07	0.00037	0.00084	0.00037	100	0.09347	2.12000	0.04674
ALUM. SIDING ANODIZED 3 Fl	SF	0.00381	0.00601	0.00381	0.10	0.00053	0.00084	0.00053	100	0.11362	2.12000	0.05681
STEEL (SELF-COATING) 1 Flr	SF	0.00222	0.01296	0.00222	0.07	0.00031	0.00181	0.00031	150	0.59007	5.53320	0.29504
STEEL (SELF-COATING) 2 Flr	SF	0.00335	0.01296	0.00335	0.09	0.00047	0.00181	0.00047	150	0.66209	5.53320	0.33105
STEEL (SELF-COATING) 3 Flr	SF	0.00441	0.01296	0.00441	0.12	0.00062	0.00181	0.00062	150	0.73385	5.53320	0.36693
STEEL (PAINTED) First Flr.	SF	0.01966	0.04994	0.01966	0.52	0.00047	0.00199	0.00047	150	0.63817	6.08440	0.34314
REFINISH STEEL (PAINTED) EXTERIOR WALL - 1									10	0.03875	0.08480	0.03875
STEEL (PAINTED) Second Flr	SF	0.02889	0.04994	0.02889	0.73	0.00077	0.00199	0.00077	150	0.72540	6.08440	0.39566
REFINISH STEEL (PAINTED) EXTERIOR WALL - 2									10	0.05563	0.08480	0.05563
STEEL (PAINTED) Third Flr.	SF	0.03797	0.04994	0.03797	0.95	0.00105	0.00199	0.00105	150	0.81718	6.08440	0.45039
REFINISH STEEL (PAINTED) EXTERIOR WALL -3R									10	0.07237	0.08480	0.07237
GLASS BLOCK First Floor	SF	0.00168	0.01762	0.00168	0.06	0.00024	0.00246	0.00024	300	1.04013	12.11580	0.52007
GLASS BLOCK Second Floor	SF	0.00290	0.01762	0.00290	0.09	0.00041	0.00246	0.00041	300	1.15713	12.11580	0.57857
GLASS BLOCK Third Floor	SF	0.00364	0.01762	0.00364	0.10	0.00051	0.00246	0.00051	300	1.27400	12.11580	0.63700
PLATE GLASS First Floor	SF	0.00838	0.19869	0.00838	0.40	0.00117	0.02778	0.00117	150	0.09906	8.48000	0.04953
PLATE GLASS Second Floor	SF	0.02619	0.19869	0.02619	0.82	0.00366	0.02778	0.00366	150	0.12194	8.48000	0.06097
PLATE GLASS Third Floor	SF	0.03609	0.19869	0.03609	1.05	0.00505	0.02778	0.00505	150	0.14469	8.48000	0.07235
FORMICA-VINYL First Floor	SF	0.00215	0.00914	0.00215	0.06	0.00030	0.00128	0.00030	40	0.02925	0.63600	0.01463
FORMICA-VINYL Second Floor	SF	0.01270	0.00914	0.01270	0.31	0.00178	0.00128	0.00178	40	0.04524	0.63600	0.02262
FORMICA-VINYL Third Floor	SF	0.01859	0.00914	0.01859	0.45	0.00260	0.00128	0.00260	40	0.06084	0.63600	0.03042
ASBESTOS First Floor	SF	0.00142	0.00883	0.00142	0.04	0.00020	0.00124	0.00020	100	0.04862	1.04940	0.02431
ASBESTOS Second Floor	SF	0.00766	0.00883	0.00766	0.19	0.00107	0.00124	0.00107	100	0.06643	1.04940	0.03322
ASBESTOS Third Floor	SF	0.01105	0.00883	0.01105	0.27	0.00155	0.00124	0.00155	100	0.08424	1.04940	0.04212
SYN. VENEER-PLASTER 1st Fl	SF	0.02183	0.03662	0.02183	0.55	0.00037	0.00086	0.00037	160	0.06486	0.73140	0.04646
REFINISH SYTHETIC VENEER									7	0.02672	0.04240	0.02672
SYN VENEER-PLASTER 2nd Fl	SF	0.04551	0.03662	0.04551	1.11	0.00210	0.00086	0.00210	160	0.09738	0.73140	0.07064
REFINISH SYTHETIC VENEER 2ND FLR.									7	0.04241	0.04240	0.04241
SYN. VENEER-PLASTER 3rd Fl	SF	0.06293	0.03662	0.06293	1.53	0.00306	0.00086	0.00306	160	0.12942	0.73140	0.09445
REFINISH SYNTHETIC VENEER 3RD FLR.									7	0.05717	0.04240	0.05717
PORCELAIN PANEL First Flr.	SF	0.01188	0.03370	0.01188	0.31	0.00166	0.00471	0.00166	125	0.08260	2.52174	0.02753
PORCELAIN PANEL Second Flr	SF	0.02021	0.03370	0.02021	0.51	0.00282	0.00471	0.00282	125	0.10390	2.52174	0.03463

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COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%): By Resources: labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS: Annual Maintenance and Repair: labor	material	equipment	Replacement and High Costs Tasks: yr	labor	material	equipment
PORCELAIN PANEL Third Flr.	SF	0.02475	0.03370	0.02475	0.62	0.00346	0.00471	0.00346	125	0.12491	2.52174	0.04164
ALUM. CORRG. PANEL 1st Flr	SF	0.00191	0.01536	0.00191	0.06	0.00027	0.00215	0.00027	60	0.02074	1.24020	0.01037
ALUM. CORRG. PANEL 2nd Flr	SF	0.01103	0.01536	0.01103	0.27	0.00154	0.00215	0.00154	60	0.04971	1.24020	0.02486
ALUM. CORRG. PANEL 3rd Flr	SF	0.01604	0.01536	0.01604	0.38	0.00224	0.00215	0.00224	60	0.07080	1.24020	0.03540
EXT. GYPSUM BRD-PNTD 1 Flr	SF	0.03673	0.07257	0.03673	0.94	0.00028	0.00110	0.00028	100	0.08843	1.31122	0.05902
REFINISH EXTERIOR GYPSUM BOARD-PNTD FIRST									4	0.02276	0.04240	0.02276
EXT. GYPSUM BRD-PNTD 2 Flr	SF	0.06895	0.07257	0.06895	1.70	0.00152	0.00110	0.00152	100	0.11682	1.31122	0.07795
REFINISH EXTERIOR GYPSUM BOARD-PNTD SECOND									4	0.03806	0.04240	0.03806
EXT. GYPSUM BRD-PNTD 3 Flr	SF	0.09679	0.07257	0.09679	2.36	0.00221	0.00110	0.00221	100	0.15060	1.31122	0.10241
REFINISH EXTERIOR GYPSUM BOARD-PNTD FIRST									4	0.05311	0.04240	0.05311
EXT.GYPSUM BRD-COVERED 1Fl	SF	0.10150	0.97887	0.10150	3.38	0.00030	0.00121	0.00030	100	0.12397	1.43736	0.09456
REFINISH EXTERIOR GYPSUM BOARD COVERED FIR									4	0.06514	0.63600	0.06514
EXT.GYPSUM BRD-COVERED 2Fl	SF	0.14020	0.97887	0.14020	4.30	0.00154	0.00121	0.00154	100	0.16229	1.43736	0.12349
REFINISH EXTERIOR GYPSUM BOARD-COVERED 2ND									4	0.08468	0.63600	0.08468
EXT.GYPSUM BRD-COVERED 3Fl	SF	0.17452	0.97887	0.17452	5.11	0.00223	0.00121	0.00223	100	0.20035	1.43736	0.15216
REFINISH EXTERIOR GYPSUM BOARD COVERED 3RD									4	0.10396	0.63600	0.10396
MASONITE PANEL, SEALED 1Fl	SF	0.00117	0.00337	0.00117	0.03	0.00016	0.00047	0.00016	100	0.05766	0.54060	0.02883
MASONITE PANEL, SEALED 2Fl	SF	0.00606	0.00337	0.00606	0.15	0.00085	0.00047	0.00085	100	0.07645	0.54060	0.03822
MASONITE PANEL, SEALED 3Fl	SF	0.00876	0.00337	0.00876	0.21	0.00122	0.00047	0.00122	100	0.09498	0.54060	0.04749
FIBERGLASS PANEL,RIGID 1Fl	SF	0.03753	0.11316	0.03753	1.00	0.00039	0.00226	0.00039	150	0.06536	1.79405	0.04748
REFINISH FIBERGLASS PANELS RIGID FIRST FLO									4	0.02276	0.06360	0.02276
FIBERGLASS PANEL,RIGID 2Fl	SF	0.07488	0.11316	0.07488	1.88	0.00235	0.00226	0.00235	150	0.09144	1.79405	0.06526
REFINISH FIBERGLASS PANELS, RIGID SECOND F									4	0.03806	0.06360	0.03806
FIBERGLASS PANEL,RIGID 3Fl	SF	0.10551	0.11316	0.10551	2.61	0.00343	0.00226	0.00343	150	0.12292	1.79405	0.08856
REFINISH FIBERGLASS PANEL, RIGID THIRD FLO									4	0.05311	0.06360	0.05311
EXTERIOR DOORS												
METAL DOORS												
ALUMINUM (PLAIN/ANODIZED)	CT	0.36210	29.83211	0.36210	38.40	0.05062	4.17081	0.05062	65	2.23574	265.00000	2.23574
AL. (P&L) FRAME/DOOR	CT	0.57641	31.79776	0.57641	45.44	0.08059	4.44562	0.08059	65	2.73004	327.87125	2.73004
AL. SLIDING EXT.(P&A) DOOR	CT	0.71627	74.74634	0.71627	91.69	0.10014	10.45023	0.10014	65	2.73004	848.38075	1.36502
AL.(WOOD CORE) EXT. DOOR	CT	0.57641	31.05107	0.57641	44.69	0.08059	4.34123	0.08059	65	2.73004	385.84000	2.73004
AL.(INSUL)P&A EXT. DOOR	CT	0.57641	31.05107	0.57641	44.69	0.08059	4.34123	0.08059	65	2.73004	381.60000	2.73004
STEEL (PAINTED)	CT	0.72785	23.15875	0.72785	40.38	0.10176	3.23781	0.10176	80	2.59350	124.74080	2.59350
STEEL PAINTED EXT. DOOR	CT	1.07489	25.12440	1.07489	50.56	0.15028	3.51262	0.15028	80	3.14685	187.53732	3.14685
ST. SLIDING PNTD EXT. DOOR	CT	0.94821	49.04687	0.94821	71.48	0.13257	6.85721	0.13257	80	3.14685	707.74080	1.78183
ST.(INSUL CORE)PNTD EXT.DR	CT	1.07489	24.37772	1.07489	49.81	0.15028	3.40823	0.15028	80	3.14685	241.34080	3.14685
STEEL (UNPAINTED)	CT	0.22693	18.69575	0.22693	24.06	0.03173	2.61384	0.03173	80	2.26369	145.22000	2.26369
ST.(GLASS)UNPNTD EXT. DOOR	CT	0.44124	20.66140	0.44124	31.10	0.06169	2.88866	0.06169	80	2.73004	220.48000	2.73004
ST.SLIDING UNPNTD EXT DOOR	CT	0.31457	46.04653	0.31457	53.49	0.04398	6.43773	0.04398	80	2.73004	844.82000	1.36502
ST.(INSUL)UNPNTD EXT. DOOR	CT	0.44125	19.91471	0.44125	30.35	0.06169	2.78426	0.06169	80	2.73004	285.14000	2.73004
FULLY GLAZED DOORS												
ALUMINIUM FRAME	CT	0.57689	31.66310	0.57689	45.31	0.08065	4.42680	0.08065	65	2.23574	395.38000	2.23574
GLAZED AL.SLIDING EXT.DOOR	CT	0.50617	25.03655	0.50617	37.01	0.07077	3.50034	0.07077	65	5.63216	636.00000	2.81608
WOOD FRAME (PAINTED)	CT	0.74435	42.39793	0.74435	60.01	0.10407	5.92762	0.10407	50	2.35677	122.57310	2.35677
GLAZED WOOD SLID. EXT. DR	CT	0.83971	30.86061	0.83971	50.73	0.11740	4.31460	0.11740	50	5.79892	460.12480	2.98284
WOOD DOORS												
HOLLOW CORE (PAINTED)	CT	1.04037	34.92316	1.04037	59.54	0.14545	4.88258	0.14545	30	2.58492	196.82080	2.58492
HOL.CORE SLID. WOOD EXT.DR	CT	1.27418	26.78241	1.27418	56.93	0.17814	3.74443	0.17814	30	6.05336	211.78800	3.23728
SOLID CORE (PAINTED)	CT	0.77021	20.27820	0.77021	38.50	0.10768	2.83508	0.10768	40	2.58492	223.32080	2.58492
SOLID SLID. WOOD EXT. DOOR	CT	0.96974	16.23803	0.96974	39.18	0.13558	2.27023	0.13558	40	6.05336	213.90800	3.23728
SOLID CORE GLASS PNTD EXT.	CT	0.98454	22.24385	0.98454	45.54	0.13765	3.10990	0.13765	40	2.58557	239.22080	2.58557
LOUVERED EXTERIOR DOOR												
METAL GRATED PNTD EXT.DOOR	CT	1.15426	7.57713	1.15426	34.89	0.16138	1.05935	0.16138	150	21.97979	218.02080	11.33121
MET. GRATED UNPTD EXT.DOOR	CT	0.11291	1.62646	0.11291	4.30	0.01579	0.22739	0.01579	150	21.29716	214.12000	10.64858
MET.WIRE MESH PNTD EXT. DR	CT	1.37266	5.96758	1.37266	38.44	0.19191	0.83432	0.19191	150	7.33475	202.12080	4.10780
METAL WIRE PNTD EXT.DOOR	CT	0.02892	0.01691	0.02892	0.70	0.00404	0.00236	0.00404	150	6.45389	198.22000	3.22695
AL. LOUVERED EXT. DOOR	CT	1.35971	23.20599	1.35971	55.38	0.19010	3.24441	0.19010	65	6.04897	508.46080	3.23289
STEEL LOUVERED EXT. DOOR	CT	1.08867	16.20921	1.08867	41.97	0.15221	2.26620	0.15221	80	6.04897	310.77080	3.23289

See NOTES on the last page of this table for Explanation of Column Headings

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%) By Resources labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS Annual Maintenance and Repair labor	material	equipment	Replacement and High Costs Tasks yr	labor	material	equipment
WOOD LOUVERED EXT. DOOR	CT	2.20903	52.89770	2.20903	105.16	0.30884	7.39559	0.30884	40	6.04897	311.30080	3.23289
EXTERIOR GATE												
ALUMINUM EXTERIOR GATE	CT	0.92261	21.24584	0.92261	43.07	0.12899	2.97037	0.12899	40	2.25334	421.24400	1.22691
STEEL EXTERIOR GATE	CT	0.77590	14.81487	0.77590	33.17	0.10848	2.07126	0.10848	65	2.25334	256.94400	1.22691
WOOD EXTERIOR GATE	CT	1.40876	117.75418	1.40876	151.09	0.19492	16.43727	0.19492	25	2.25334	475.30400	1.22691
REPLACE WOOD EXTERIOR GATE (WALK & DRIVEWA									25	2.05286	472.76000	1.02643
WROUGHT IRON EXT. GATE	CT	0.84437	16.31251	0.84437	36.29	0.11805	2.28064	0.11805	65	2.25334	256.94400	1.22691
SCREEN/STORM DOORS												
ALUMINUM (PLAIN/ANODIZED)	CT	2.32762	77.85509	2.32762	132.93	0.28882	8.28177	0.28882	20	2.23574	159.00000	2.23574
PLASTIC	CT	1.59742	73.26243	1.59742	111.06	0.18627	8.28177	0.18627	20	2.26369	119.78000	2.26369
ROLL-UP DOORS												
ST.FRAME-SINGLE (PAINTED)	CT	3.03886	71.27391	3.03886	143.17	0.42486	9.96476	0.42486	35	4.84587	176.85040	2.67316
ST. FRAME-DOUBLE (PAINTED)	CT	5.57938	91.93730	5.57938	223.95	0.78005	12.85369	0.78005	35	5.38802	445.73000	3.21531
AL. SINGLE ROLL-UP DOOR	CT	2.67603	131.98512	2.67603	195.30	0.36854	18.40722	0.36854	24	4.84587	135.24540	2.67316
REPLACE ALUMINUM SINGLE ROLL-UP DOOR									24	4.34542	131.17500	2.17271
AL. DOUBLE ROLL-UP DOOR	CT	5.10227	151.71897	5.10227	272.44	0.70168	21.11688	0.70168	24	5.38802	478.85500	3.21531
REPLACE ALUMINUM DOUBLE ROLL-UP DOOR									24	4.34542	470.37500	2.17271
WOOD SINGLE ROLL-UP DOOR	CT	2.72829	160.27805	2.72829	224.83	0.36944	22.31077	0.36944	16	4.84587	239.92040	2.67316
REPLACE WOOD SINGLE ROLL-UP DOOR									16	4.34542	235.85000	2.17271
WOOD DOUBLE ROLL-UP DOOR	CT	5.18115	232.89302	5.18115	355.48	0.69937	32.35728	0.69937	16	5.38802	538.48000	3.21531
REPLACE WOOD DOUBLE ROLL-UP DOOR									16	4.34542	530.00000	2.17271
AL.(ONE LEAF) SPRING DOOR	CT	2.42326	51.23327	2.42326	108.57	0.33879	7.16289	0.33879	48	11.41516	424.38160	6.70848
STEEL(ONE LEAF)SPRING DOOR	CT	2.31927	37.67733	2.31927	92.55	0.32426	5.26764	0.32426	70	11.41516	387.28160	6.70848
WOOD(ONE LEAF) SPRING DOOR	CT	2.25365	82.30518	2.25365	135.63	0.31508	11.50703	0.31508	32	11.10961	440.28160	6.40293
EXTERIOR WINDOWS												
OPERABLE WINDOWS												
ALUMINIUM OPER. First Flr.	CT	0.17042	1.22751	0.17042	5.26	0.02383	0.17162	0.02383	75	3.30634	154.76000	3.30634
ALUMINIUM OPER. Second Flr	CT	0.27883	1.22751	0.27883	7.82	0.03898	0.17162	0.03898	75	4.21782	154.76000	4.21782
ALUMINIUM OPER. Third Flr.	CT	1.92611	1.22751	1.92611	46.80	0.26929	0.17162	0.26929	75	5.12929	154.76000	5.12929
STEEL FRAME-OPER(PNTD) 1Fl	CT	0.50501	1.54426	0.50501	13.49	0.07061	0.21590	0.07061	80	3.59195	275.80999	3.59195
STEEL FRAME-OPER(PNTD) 2Fl	CT	2.31090	1.54426	2.31090	56.22	0.32309	0.21590	0.32309	80	5.95241	275.80999	5.95241
STEEL FRAME-OPER(PNTD) 3Fl	CT	3.35720	1.54426	3.35720	80.98	0.46937	0.21590	0.46937	80	7.70654	275.80999	7.70654
WOOD FRAME-OPER(PNTD) 1 Fl	CT	0.61048	1.46670	0.61048	15.91	0.08535	0.20506	0.08535	50	3.63199	94.51999	3.63199
WOOD FRAME-OPER(PNTD) 2 Fl	CT	2.30108	1.40299	2.30108	55.85	0.32171	0.19615	0.32171	50	5.99245	94.51999	5.99245
WOOD FRAME-OPER(PNTD) 3 Fl	CT	3.34738	1.40299	3.34738	80.60	0.46800	0.19615	0.46800	50	7.74658	94.51999	7.74658
PLASTIC (WOOD CORE)FRM 1Fl	CT	0.11965	1.34981	0.11965	4.18	0.01673	0.18872	0.01673	75	3.30634	137.80000	3.30634
PLASTIC (WOOD CORE)FRM 2Fl	CT	0.23206	1.34981	0.23206	6.84	0.03244	0.18872	0.03244	75	4.21782	137.80000	4.21782
PLASTIC (WOOD CORE)FRM 3Fl	CT	0.29519	1.34981	0.29519	8.33	0.04127	0.18872	0.04127	75	5.12929	137.80000	5.12929
GLASS BLOCK-OPER First Flr	CT	0.36345	2.90650	0.36345	11.51	0.05081	0.40636	0.05081	100	3.02718	281.67592	3.02718
GLASS BLOCK-OPER Second Fl	CT	1.35913	2.90650	1.35913	35.06	0.19002	0.40636	0.19002	100	4.47642	281.67592	4.47642
GLASS BLOCK-OPER Third Flr	CT	1.93459	2.90650	1.93459	48.68	0.27047	0.40636	0.27047	100	5.31882	281.67592	5.31882
ALUMINUM DOUBLE-OPER 1 Flr	CT	0.31269	2.30792	0.31269	9.71	0.04372	0.32267	0.04372	75	3.30634	213.06000	3.30634
ALUMINUM DOUBLE-OPER 2 Flr	CT	0.42109	2.30792	0.42109	12.27	0.05887	0.32267	0.05887	75	4.21782	213.06000	4.21782
ALUMINUM DOUBLE-OPER 3 Flr	CT	0.48021	2.30792	0.48021	13.67	0.06714	0.32267	0.06714	75	5.12929	213.06000	5.12929
STEEL FRAME(DBL)-OPER 1 Fl	CT	0.66647	2.90605	0.66647	18.67	0.09318	0.40629	0.09318	80	3.60833	394.73997	3.60833
STEEL FRAME(DBL)-OPER 2 Fl	CT	2.47235	2.90605	2.47235	61.40	0.34566	0.40629	0.34566	80	5.96879	394.73997	5.96879
STEEL FRAME(DBL)-OPER 3 Fl	CT	3.51865	2.90605	3.51865	86.16	0.49194	0.40629	0.49194	80	7.72292	394.73997	7.72292
WOOD FRAME(DBL)-OPER 1 Flr	CT	0.97734	2.83136	0.97734	25.96	0.13664	0.39585	0.13664	50	3.96973	123.45184	3.96973
WOOD FRAME(DBL)-OPER 2 Flr	CT	2.78322	2.83136	2.78322	68.68	0.38912	0.39585	0.38912	50	6.33019	123.45184	6.33019
WOOD FRAME(DBL)-OPER 3 Flr	CT	3.82952	2.83136	3.82952	93.44	0.53540	0.39585	0.53540	50	8.08432	123.45184	8.08432
PLASTIC (WOOD)FRM-OPER 1Fl	CT	0.20612	2.44778	0.20612	7.32	0.02882	0.34222	0.02882	70	3.30634	187.62000	3.30634
PLASTIC (WOOD)FRM-OPER 2Fl	CT	0.31853	2.44778	0.31853	9.98	0.04453	0.34222	0.04453	70	4.21782	187.62000	4.21782
PLASTIC (WOOD)FRM-OPER 3Fl	CT	0.38166	2.44778	0.38166	11.48	0.05336	0.34222	0.05336	70	5.12929	187.62000	5.12929
INOPERABLE WINDOWS												
ALUMINIUM-FIXED First Flr.	CT	0.17042	1.20889	0.17042	5.24	0.02383	0.16901	0.02383	75	3.30634	122.96000	3.30634
ALUMINIUM-FIXED Second Flr	CT	0.27883	1.20889	0.27883	7.81	0.03898	0.16901	0.03898	75	4.21782	122.96000	4.21782
ALUMINIUM-FIXED Third Flr.	CT	0.33795	1.20889	0.33795	9.20	0.04725	0.16901	0.04725	75	5.12929	122.96000	5.12929
STEEL FRAME(PNTD)-FXD 1 Fl	CT	0.50501	1.45861	0.50501	13.41	0.07061	0.20393	0.07061	80	3.59195	129.52999	3.59195

See NOTES on the last page of this table for Explanation of Column Headings

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION		PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%)				ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS						
		By Resources			Washington	Annual Maintenance and Repair			Replacement and High Costs Tasks			
	UM	labor	material	equipment	D.C. Total	labor	material	equipment	yr	labor	material	equipment
STEEL FRAME(PNTD)-FXD 2 Fl	CT	2.31090	1.45861	2.31090	56.13	0.32309	0.20393	0.32309	80	5.95241	129.52999	5.95241
STEEL FRAME(PNTD)-FXD 3 Fl	CT	3.35720	1.45861	3.35720	80.89	0.46937	0.20393	0.46937	80	7.70654	129.52999	7.70654
WOOD FRAME(PNTD)-FXD 1 Flr	CT	1.09007	1.62238	1.09007	27.[illegible]1	0.15240	0.22682	0.15240	50	4.13977	229.25998	4.13977
WOOD FRAME(PNTD)-FXD 2 Flr	CT	2.69675	1.62238	2.69675	65.43	0.37703	0.22682	0.37703	50	6.33019	229.25998	6.33019
WOOD FRAME(PNTD)-FXD 3 Flr	CT	4.78913	1.72857	4.78913	115.04	0.66956	0.24167	0.66956	50	8.08432	229.25998	8.08432
PLASTIC (WOOD)FRM-FXD 1 Fl	CT	0.11965	1.45429	0.11965	4.29	0.01673	0.20332	0.01673	70	3.30634	238.50000	3.30634
PLASTIC (WOOD)FRM-FXD 2 Fl	CT	0.23206	1.45429	0.23206	6.94	0.03244	0.20332	0.03244	70	4.21782	238.50000	4.21782
PLASTIC (WOOD)FRM-FXD 3 Fl	CT	0.29519	1.45429	0.29519	8.44	0.04127	0.20332	0.04127	70	5.12929	238.50000	5.12929
GLASS BLOCK FIXED 1st Flr.	CT	0.36345	2.90650	0.36345	11.51	0.05081	0.40636	0.05081	100	3.02718	150.23592	3.02718
GLASS BLOCK-FIXED 2nd Flr.	CT	1.36388	2.90650	1.36388	35.18	0.19068	0.40636	0.19068	100	4.47642	150.23592	4.47642
GLASS BLOCK-FIXED 3rd Flr.	CT	1.93934	2.90650	1.93934	48.79	0.27114	0.40636	0.27114	100	5.34482	150.23592	5.34482
ALUMINIUM DBL-FXD 1st Flr.	CT	0.31269	2.27999	0.31269	9.68	0.04372	0.31876	0.04372	75	3.30634	165.36000	3.30634
ALUMINIUM DBL-FXD 2nd Flr.	CT	0.42109	2.27999	0.42109	12.24	0.05887	0.31876	0.05887	75	4.21782	165.36000	4.21782
ALUMINIUM DBL-FXD 3rd Flr.	CT	0.48021	2.27999	0.48021	13.64	0.06714	0.31876	0.06714	75	5.12929	165.36000	5.12929
STEEL FRAME(DBL)-FXD 1 Flr	CT	0.66647	2.77236	0.66647	18.54	0.09318	0.38760	0.09318	80	3.60833	175.31552	3.60833
STEEL FRAME(DBL)-FXD 2 Flr	CT	2.47235	2.77236	2.47235	61.27	0.34566	0.38760	0.34566	80	5.96879	175.31552	5.96879
STEEL FRAME(DBL)-FXD 3 Flr	CT	3.51865	2.77236	3.51865	86.02	0.49194	0.38760	0.49194	80	7.72292	175.31552	7.72292
WOOD FRAME(DBL)-FXD 1st Fl	CT	1.21218	3.28771	1.21218	31.97	0.16947	0.45965	0.16947	50	3.96973	323.89996	3.96973
WOOD FRAME(DBL)-FXD 2nd Fl	CT	3.53100	3.28771	3.53100	86.83	0.49367	0.45965	0.49367	50	6.33019	323.89996	6.33019
WOOD FRAME(DBL)-FXD 3rd Fl	CT	4.87560	3.28771	4.87560	118.64	0.68165	0.45965	0.68165	50	8.08432	323.89996	8.08432
PLASTIC (WOOD)DBL-FXD 1 Fl	CT	0.20612	2.60505	0.20612	7.48	0.02882	0.36421	0.02882	70	3.30634	339.20000	3.30634
PLASTIC (WOOD)DBL-FXD 2 Fl	CT	0.31667	2.60505	0.31667	10.10	0.04427	0.36421	0.04427	70	4.21782	339.20000	4.21782
PLASTIC (WOOD)DBL-FXD 3 Fl	CT	0.38166	2.60505	0.38166	11.64	0.05336	0.36421	0.05336	70	5.12929	339.20000	5.12929
LOUVERS & SHUTTERS												
WOOD LOUVER First Floor	CT	1.47696	24.01999	1.47696	58.96	0.20649	3.35822	0.20649	75	5.95304	81.28080	5.95304
WOOD LOUVER Second Floor	CT	3.23628	24.65039	3.23628	101.22	0.45246	3.44635	0.45246	75	8.05853	81.28080	8.05853
WOOD LOUVER Third Floor	CT	3.58578	24.01999	3.58578	108.86	0.50133	3.35822	0.50133	75	10.16402	81.28080	10.16402
ALUM. LOUVER First Floor	CT	1.35992	33.48026	1.35992	65.66	0.19013	4.68085	0.19013	80	5.95304	317.66080	5.95304
ALUM. LOUVER Second Floor	CT	2.39121	33.48026	2.39121	90.06	0.33431	4.68085	0.33431	80	8.05853	317.66080	8.05853
ALUM. LOUVER Third Floor	CT	3.41706	33.48026	3.41706	114.33	0.47774	4.68085	0.47774	80	10.16402	317.66080	10.16402
STEEL LOUVER First Floor	CT	1.32808	12.23925	1.32808	43.66	0.18568	1.71116	0.18568	150	5.95304	198.94080	5.95304
STEEL LOUVER Second Floor	CT	2.35102	12.23925	2.35102	67.86	0.32869	1.71116	0.32869	150	8.05853	198.94080	8.05853
STEEL LOUVER Third Floor	CT	3.37115	12.23925	3.37115	92.00	0.47132	1.71116	0.47132	150	10.16402	198.94080	10.16402
WOOD SHUTTER First Floor	CT	1.47696	24.01999	1.47696	58.96	0.20649	3.35822	0.20649	75	2.41972	81.28080	2.41972
WOOD SHUTTER Second Floor	CT	2.53891	24.01999	2.53891	84.09	0.35496	3.35822	0.35496	75	4.17188	81.28080	4.17188
WOOD SHUTTER Third Floor	CT	3.58578	24.01999	3.58578	108.86	0.50133	3.35822	0.50133	75	5.92404	81.28080	5.92404
ALUM. SHUTTER First Floor	CT	1.37784	41.99486	1.37784	74.59	0.19264	5.87127	0.19264	80	2.41972	317.66080	2.41972
ALUM. SHUTTER Second Floor	CT	2.41382	41.99486	2.41382	99.11	0.33748	5.87127	0.33748	80	4.17188	317.66080	4.17188
ALUM. SHUTTER Third Floor	CT	3.44289	41.99486	3.44289	123.45	0.48135	5.87127	0.48135	80	5.92404	317.66080	5.92404
STEEL SHUTTER First Floor	CT	1.35992	21.68780	1.35992	53.86	0.19013	3.03216	0.19013	150	2.41972	198.94080	2.41972
STEEL SHUTTER Second Floor	CT	2.39121	21.68780	2.39121	78.26	0.33431	3.03216	0.33431	150	4.17188	198.94080	4.17188
STEEL SHUTTER Third Floor	CT	3.41706	21.68780	3.41706	102.54	0.47774	3.03216	0.47774	150	5.92404	198.94080	5.92404
WINDOW COV. SPECIAL EXT.												
ALUM. FRAME STORM WNDW 1Fl	CT	1.38847	1.35362	1.38[illegible]	34.20	0.19412	0.18925	0.19412	80	2.63991	111.53998	2.63991
ALUM. FRAME STORM WNDW 2Fl	CT	2.61847	1.35362	2.61847	63.31	0.36609	0.18925	0.36609	80	4.41409	111.53998	4.41409
ALUM. FRAME STORM WNDW 3Fl	CT	3.75691	1.35362	3.75691	90.24	0.52525	0.18925	0.52525	80	6.18827	111.53998	6.18827
STEEL FRAME STORM WNDW 1Fl	CT	1.22370	1.32742	1.22370	30.28	0.17108	0.18559	0.17108	100	2.63991	89.27998	2.63991
STEEL FRAME STORM WNDW 2Fl	CT	2.33378	1.32742	2.33378	56.54	0.32628	0.18559	0.32628	100	4.41409	89.27998	4.41409
STEEL FRAME STORM WNDW 3Fl	CT	3.39644	1.32742	3.39644	81.69	0.47485	0.18559	0.47485	100	6.18827	89.27998	6.18827
WOOD FRAME STORM WNDW 1 Fl	CT	1.57703	1.38361	1.57703	38.70	0.22048	0.19344	0.22048	50	2.63991	93.89098	2.63991
WOOD FRAME STORM WNDW 2 Fl	CT	2.94427	1.38361	2.94427	71.05	0.41164	0.19344	0.41164	50	4.41409	93.89098	4.41409
WOOD FRAME STORM WNDW 3 Fl	CT	4.16941	1.38361	4.16941	100.03	0.58292	0.19344	0.58292	50	6.18827	93.89098	6.18827
METAL WINDOW GRATING 1stFl	CT	1.91437	5.79887	1.91437	51.09	0.26765	0.81074	0.26765	150	23.23632	116.12300	23.23632
METAL WINDOW GRATING 2ndFl	CT	2.99312	5.79887	2.99312	76.62	0.41847	0.81074	0.41847	150	27.07014	116.12300	27.07014
METAL WINDOW GRATING 3rdFl	CT	4.07062	5.79887	4.07062	102.11	0.56911	0.81074	0.56911	150	30.90396	116.12300	30.90396
METAL WIRE MESH COVER 1 Fl	CT	2.06261	4.18933	2.06261	52.99	0.28837	0.58571	0.28837	150	4.10490	95.59080	4.10490
METAL WIRE MESH COVER 2 Fl	CT	3.15618	4.18933	3.15618	78.86	0.44126	0.58571	0.44126	150	6.02557	95.59080	6.02557
METAL WIRE MESH COVER 3 Fl	CT	4.24851	4.18933	4.24851	104.71	0.59398	0.58571	0.59398	150	7.94625	95.59080	7.94625

See NOTES on the last page of this table for Explanation of Column Readings

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%) By Resources: labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS — Annual Maintenance and Repair: labor	material	equipment	Replacement and High Costs Tasks: yr	labor	material	equipment
ALUM.FRM SCRN WNDW CVR 1Fl	CT	1.06683	0.39140	1.06683	25.63	0.14915	0.05472	0.14915	70	3.08433	42.39618	3.08433
ALUM.FRM SCRN WNDW CVR 2Fl	CT	2.05979	0.39140	2.05979	49.13	0.28798	0.05472	0.28798	70	4.90295	42.39618	4.90295
ALUM.FRM SCRN WNDW CVR 3Fl	CT	3.05198	0.39140	3.05198	72.60	0.42670	0.05472	0.42670	70	6.72157	42.39618	6.72157
STEEL FRM SCRN WNDW CVR 1F	CT	1.06683	0.39140	1.06683	25.63	0.14915	0.05472	0.14915	80	3.08433	39.39638	3.08433
STEEL FRM SCRN WNDW CVR 2F	CT	2.05979	0.39140	2.05979	49.13	0.28798	0.05472	0.28798	80	4.90295	39.39638	4.90295
STEEL FRM SCRN WNDW CVR 3F	CT	3.05198	0.39140	3.05198	72.60	0.42670	0.05472	0.42670	80	6.72157	39.39638	6.72157
WOOD FRM SCRN WNDW CVR 1Fl	CT	1.06683	0.39140	1.06683	25.63	0.14915	0.05472	0.14915	40	3.08433	40.02178	3.08433
WOOD FRM SCRN WNDW CVR 2Fl	CT	2.05979	0.39140	2.05979	49.13	0.28798	0.05472	0.28798	40	4.90295	40.02178	4.90295
WOOD FRM SCRN WNDW CVR 3Fl	CT	3.05198	0.39140	3.05198	72.60	0.42670	0.05472	0.42670	40	6.72157	40.02178	6.72157
LEAD-LINED WNDW(W/FR) 1Flr	CT	1.22370	1.32742	1.22370	30.28	0.17108	0.18559	0.17108	100	2.63991	248.28316	1.77290
LEAD-LINED WNDW(W/FR) 2Flr	CT	2.33378	1.32742	2.33378	56.54	0.32628	0.18559	0.32628	100	4.41409	248.28316	3.08283
LEAD-LINED WNDW(W/FR) 3Flr	CT	3.39644	1.32742	3.39644	81.69	0.47485	0.18559	0.47485	100	6.18827	248.28316	4.39277
EXTERIOR PORCHES												
DECKS												
CONCRETE	SF	0.02044	0.06408	0.02044	0.55	0.00286	0.00896	0.00286	300	1.24579	17.78680	0.63349
WOOD	SF	0.01876	0.13088	0.01876	0.57	0.00262	0.01830	0.00262	200	0.06968	2.84080	0.04277
METAL DECKING-PORCH	SF	0.01987	0.04795	0.01987	0.52	0.00278	0.00670	0.00278	65	0.32421	0.96460	0.17285
RAILINGS												
WROUGHT IRON	LF	0.04186	0.09846	0.04186	1.09	0.00585	0.01377	0.00585	200	4.32328	53.08480	2.18088
WOOD	LF	0.02649	0.09531	0.02649	0.72	0.00370	0.01333	0.00370	100	0.37154	4.93536	0.19409
STEEL RAILING PAINTED	LF	0.04186	0.09587	0.04186	1.09	0.00585	0.01340	0.00585	200	2.18088	27.11480	1.10968
STEEL RAILING UNPAINTED	LF	0.01414	0.03476	0.01414	0.37	0.00198	0.00486	0.00198	200	2.14240	27.03000	1.07120
DECK SUPPORT MEMBERS												
CONCRETE	SF	0.01846	0.06288	0.01846	0.50	0.00258	0.00879	0.00258	500	3.60971	17.78680	1.81545
WOOD	SF	0.00682	0.31840	0.00682	0.48	0.00095	0.04452	0.00095	100	0.19279	4.74880	0.10433
CLAY BRICK	SF	0.01797	0.06636	0.01797	0.49	0.00251	0.00928	0.00251	500	1.12554	2.32140	0.57343
STEEL EXT. PORCH SUPPORT	SF	0.00747	0.06822	0.00747	0.24	0.00104	0.00954	0.00104	200	0.19279	27.51760	0.10433
COLUMNS												
METAL	LF	0.04231	0.40306	0.04231	1.40	0.00592	0.05635	0.00592	200	0.22945	18.06240	0.13507
WOOD	LF	0.02108	0.23724	0.02108	0.74	0.00295	0.03317	0.00295	200	0.23842	1.20840	0.12851
CLAY BRICK	LF	0.02707	0.26814	0.02707	0.91	0.00378	0.03749	0.00378	500	1.13152	9.20080	0.57779
EXTERIOR ORNAMENT												
CORNICES												
STONE	LF	0.00773	0.00017	0.00773	0.18	0.00108	0.00002	0.00108	300	0.26507	95.40000	0.13254
WOOD	LF	0.04388	0.06608	0.04388	1.10	0.00615	0.00924	0.00613	200	0.28496	3.52980	0.17251
EXTERIOR STAIRS												
RAILINGS												
WOOD	LF	0.01293	0.11334	0.01293	0.42	0.00181	0.01585	0.00181	100	0.16835	3.87536	0.09210
METAL	LF	0.02105	0.08766	0.02105	0.59	0.00294	0.01226	0.00294	300	0.78195	26.61236	0.40170
WROUGHT IRON EXT.ST. RAIL.	LF	0.04186	0.09836	0.04186	1.09	0.00585	0.01375	0.00585	200	2.18088	27.11480	1.10968
STEEL UNPNTD.-EXT. STAIR	LF	0.01017	0.00652	0.01017	0.25	0.00142	0.00091	0.00142	300	2.14240	27.03000	1.07120
STEPS												
CONCRETE	SF	0.00767	0.00776	0.00767	0.19	0.00107	0.00108	0.00107	300	2.93605	16.87520	1.46803
WOOD	SF	0.01490	0.07770	0.01490	0.43	0.00208	0.01086	0.00208	100	0.46410	3.68456	0.23998
METAL	SF	0.01244	0.17262	0.01244	0.47	0.00174	0.02413	0.00174	300	2.16216	35.06480	1.09181
MASONRY STEPS (UNPAINTED)	SF	0.00374	0.00524	0.00374	0.09	0.00052	0.00073	0.00052	400	1.19119	2.23660	0.59560
MASONARY STEPS (PAINTED)	SF	0.02338	0.06375	0.02338	0.62	0.00327	0.00891	0.00327	400	1.61909	2.30020	0.82020
QUARRY TILE STEPS	SF	0.00603	0.00940	0.00603	0.15	0.00084	0.00131	0.00084	300	1.59774	2.49100	0.79887
EXTERIOR HARDWARE												
HINGES												
BRASS	CT	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	60	0.21151	19.08000	0.21151
LOCK SET												
BRASS	CT	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	30	1.64840	124.02000	1.64840
DOOR CLOSER												
BRASS	CT	0.09319	16.99286	0.09319	19.20	0.00000	0.00000	0.00000	15	0.49413	90.10000	0.49413
DEADBOLT												
BRASS	CT	0.11000	9.30945	0.11000	11.91	0.00000	0.00000	0.00000	20	0.93938	79.50000	0.93938
WEATHER STRIPING												

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EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%) By Resources labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS Annual Maintenance and Repair labor	material	equipment	Replacement and High Costs Tasks yr	labor	material	equipment
BRASS EXIT BOLT METAL	CT	0.07800	3.10315	0.07800	4.95	0.00000	0.00000	0.00000	20	0.66612	26.50000	0.66612
	CT	0.14974	30.82480	0.14974	34.37	0.00000	0.00000	0.00000	25	2.05972	424.00000	2.05972

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EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%) — By Resources: labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS — Annual Maintenance and Repair: labor	material	equipment	Replacement and High Costs Tasks: yr	labor	material	equipment
ARCHITECTURE												
INTERIOR PARTITION												
MOVABLE PARTITION-METAL												
MOVABLE PARTITION - STEEL	SF	0.00350	0.00000	0.00350	0.08	0.00049	0.00000	0.00049	100	0.22022	34.98000	0.11011
MOVABLE PARTITION-FABRIC												
MOVEABLE PARTITIONS -FABR.	SF	0.00179	0.00984	0.00179	0.05	0.00025	0.00138	0.00025	100	0.22022	51.91880	0.11011
INTERIOR DOORS												
METAL DOORS												
ST. PAINTED INTERIOR DOOR	CT	0.85524	23.15875	0.85524	43.39	0.11957	3.23781	0.11957	80	3.14685	124.74080	3.14685
ST.(W/SAFETY GLASS)PAINTED	CT	1.06957	25.12440	1.06957	50.43	0.14954	3.51262	0.14954	80	3.14685	187.53732	3.14685
ST. SLIDING PNTD. INT.DOOR	CT	0.94822	43.54812	0.94822	65.98	0.13257	6.08843	0.13257	80	3.14685	707.74080	3.14685
ST.(INSUL. CORE)PNTD INT.	CT	1.06957	24.37772	1.06957	49.68	0.14954	3.40823	0.14954	80	3.14685	241.34080	3.14685
STEEL UNPAINTED INT. DOOR	CT	0.22161	18.69575	0.22161	23.94	0.03098	2.61384	0.03098	80	2.73004	145.22000	2.73004
ST.(SAFETY GLASS)UNPNT INT	CT	0.43593	20.66140	0.43593	30.98	0.06095	2.88866	0.06095	80	2.73004	220.48000	2.73004
ST.SLIDING UNPNTD.INT.DOOR	CT	0.31458	40.54778	0.31458	47.99	0.04398	5.66896	0.04398	80	2.73004	844.82000	2.73004
ST.(INSUL.CORE)UNPNTD.INT.	CT	0.43593	19.91471	0.43593	30.23	0.06095	2.78426	0.06095	80	2.73004	285.14000	2.73004
AL.(PLAIN & ANODIZED)INT.	CT	0.35361	29.83211	0.35361	38.20	0.04944	4.17081	0.04944	65	2.73004	265.00000	2.73004
AL.(P&L)(SAFETY GLASS) FR.	CT	0.56793	31.79776	0.56793	45.24	0.07940	4.44562	0.07940	65	2.73004	327.16052	2.73004
AL. SLIDING INTERIOR DOOR	CT	0.71630	65.97219	0.71630	82.92	0.10014	9.22353	0.10014	65	2.73004	848.00000	2.73004
AL.(WOOD CORE) INT. DOOR	CT	0.56793	31.05107	0.56793	44.49	0.07940	4.34123	0.07940	65	2.73004	385.84000	2.73004
AL.(INSUL.)F&A INT. DOOR	CT	0.56793	31.05107	0.56793	44.49	0.07940	4.34123	0.07940	65	2.73004	383.72000	2.73004
FULLY GLAZED DOORS												
FULLY GLAZED AL. FR. DOOR	CT	0.56793	44.48006	0.56793	57.92	0.07940	6.21873	0.07940	65	2.73004	395.38000	2.73004
FULLY GLAZED AL.FR. SLID.	CT	0.71630	75.89152	0.71630	92.84	0.10014	10.61034	0.10014	65	5.63216	636.00000	2.81608
FULLY GLAZED WOODEN FR. DR	CT	0.91824	55.93446	0.91824	77.66	0.12838	7.82016	0.12838	50	2.89680	123.04480	2.89680
GLAZED WOOD FR.SLIDING INT	CT	1.10684	92.11755	1.10684	118.31	0.15475	12.87889	0.15475	50	5.79892	460.12480	2.98284
WOOD DOORS												
HOLLOW CORE INT.PNTD. DOOR	CT	2.19657	69.19084	2.19657	121.16	0.30710	9.67352	0.30710	30	3.67727	184.10080	3.67727
HOLLOW CORE SLIDING INT.	CT	1.45054	72.52906	1.45054	106.85	0.20280	10.14024	0.20280	30	6.05336	158.78800	3.23728
SOLID CORE INT. PNTD. DOOR	CT	1.82769	38.07030	1.82769	81.31	0.25553	5.32258	0.25553	40	3.67727	186.22080	3.67727
SOLID CORE SLIDING INT. DR	CT	1.06427	67.87620	1.06427	93.06	0.14879	9.48972	0.14879	40	6.05336	269.02800	3.23728
SOLID CORE(SAF GLASS)PNTD	CT	1.09062	40.03595	1.09062	65.84	0.15248	5.59740	0.15248	40	5.95573	221.88132	5.95573
BIFOLD DOORS												
PANELED	CT	0.46797	16.97026	0.46797	28.04	0.06259	2.31806	0.06259	24	4.87323	52.57600	4.87323
REPLACE PANELED (PAINTED) INTERIOR DOORS									24	4.61968	47.70000	4.61968
LOUVERED	CT	1.02301	12.79408	1.02301	37.00	0.13877	1.71522	0.13877	24	5.00001	86.07200	5.00001
REPLACE LOUVERED (PAINTED) INTERIOR DOORS									24	4.61968	79.50000	4.61968
AL. LOUVERED INTERIOR DOOR	CT	1.45013	44.26395	1.45013	78.57	0.20274	6.18851	0.20274	65	6.04897	508.46080	6.04897
STEEL LOUVERED INT. DOOR	CT	1.14533	29.40621	1.14533	56.50	0.16013	4.11126	0.16013	80	6.04897	310.77080	3.23289
WOOD LOUVERED INT. DOOR	CT	2.89645	124.68718	2.89645	193.22	0.40495	17.43243	0.40495	40	6.04897	311.30080	6.04897
STEEL VAULT DOOR	CT	0.22161	18.69575	0.22161	23.94	0.03098	2.61384	0.03098	300	69.32900	32860.00000	23.10967
METAL WALK-IN COOLER DOOR	CT	0.22161	18.69575	0.22161	23.72	0.03098	2.61384	0.03098	70	40.40400	649.25000	13.46800
LEAD-LINED(WOOD) MEDICAL	CT	0.50825	42.87859	0.50825	54.41	0.07106	5.99483	0.07106	80	2.73004	510.92000	2.73004
METAL WIRE MESH PNTD. INT	CT	1.37266	5.96758	1.37266	38.44	0.19191	0.83432	0.19191	150	7.33475	202.12080	4.10780
METAL WIRE MESH PNTD. INT	CT	0.02892	0.01691	0.02892	0.70	0.00404	0.00236	0.00404	150	6.45389	198.22000	3.22695
GARAGE & ROLL-UP DOORS												
STEEL SINGLE ROLL-UP DOOR	CT	3.49016	147.52993	3.49016	230.11	0.48796	20.62606	0.48796	35	4.84587	176.32040	2.67316
STEEL DOUBLE ROLL-UP DOOR	CT	6.79837	219.05271	6.79837	379.90	0.95048	30.62561	0.95048	35	5.38802	445.73000	3.21531
AL. SINGLE ROLL-UP DOOR	CT	3.37005	137.62995	3.37005	217.37	0.46557	19.19642	0.46557	24	4.84587	135.24540	2.67316
REPLACE ALUMINUM SINGLE ROLL-UP DOOR									24	4.34542	131.17500	2.17271
AL. DOUBLE ROLL-UP DOOR	CT	6.54815	163.47903	6.54815	318.41	0.90383	22.76104	0.90383	24	5.38802	478.85500	3.21531
REPLACE ALUMINUM DOUBLE ROLL-UP DOOR INTER									24	4.34542	470.37500	2.17271
WOOD SINGLE ROLL-UP DOOR	CT	3.26037	164.60570	3.26037	241.75	0.44383	22.91581	0.44383	16	4.84587	239.92040	2.67316
REPLACE WOOD SINGLE ROLL-UP DOOR									16	4.34542	235.85000	2.17271
WOOD DOUBLE ROLL-UP DOOR	CT	5.18115	232.89302	5.18115	355.48	0.69937	32.35728	0.69937	16	5.38802	538.48000	3.21531
REPLACE WOOD DOUBLE ROLL-UP DOOR									16	4.34542	530.00000	2.17271
FIREPLACE												
CHIMNEY												

See NOTES on the last page of this table for Explanation of Column Headings

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%) By Resources labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS Annual Maintenance and Repair labor	material	equipment	yr	Replacement and High Costs Tasks labor	material	equipment
CLAY BRICK	SF	0.00208	0.00174	0.00208	0.05	0.00029	0.00024	0.00029	500	1.34004	4.87600	0.67002
CONCRETE BRICK	SF	0.00208	0.00216	0.00208	0.05	0.00029	0.00030	0.00029	500	1.34004	1.66547	0.67002
STONE	SF	0.00053	0.00262	0.00053	0.02	0.00007	0.00037	0.00007	500	0.34931	1.99386	0.17466
METAL PIPE CHIMNEY	SF	0.00152	0.08730	0.00152	0.12	0.00021	0.01220	0.00021	200	1.82390	4.67248	0.91195
MANTEL												
WOOD	LF	0.01365	0.06350	0.01365	0.39	0.00191	0.00892	0.00191	200	0.58058	0.72080	0.29822
CONCRETE	LF	0.00693	0.00482	0.00693	0.17	0.00097	0.00067	0.00097	300	0.18616	19.61000	0.09308
STONE	LF	0.00043	0.00422	0.00043	0.01	0.00006	0.00059	0.00006	300	0.18616	1.80200	0.09308
FINISH												
BRICK	SF	0.00998	0.05053	0.00998	0.29	0.00140	0.00706	0.00140	300	1.08828	1.30380	0.54989
CONCRETE BLOCK	SF	0.00998	0.21842	0.00998	0.45	0.00140	0.03054	0.00140	300	1.08828	1.55820	0.54989
PLASTER	SF	0.00789	0.05690	0.00789	0.24	0.00110	0.00796	0.00110	100	0.23680	0.96460	0.23680
WOOD	SF	0.00787	0.04881	0.00787	0.24	0.00110	0.00682	0.00110	100	0.29517	0.92220	0.15269
FIREBRICK												
FIRE BRICK	SF	0.00251	0.00233	0.00251	0.06	0.00035	0.00033	0.00035	300	1.07679	0.99640	0.53840
FLUES ARCHITECTURAL												
BAKED CLAY FLUE, ARCH.	LF	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	400	1.34004	4.73502	0.67002
METAL PIPE FLUE, ARCH.	LF	0.00152	0.06418	0.00152	0.10	0.00021	0.00897	0.00021	200	1.82390	3.61248	0.91195
INTERIOR ORNAMENT												
INTERIOR TRIM												
WOOD	LF	0.00694	0.04951	0.00694	0.21	0.00097	0.00692	0.00097	100	0.04778	0.85860	0.02899
METAL	LF	0.00788	0.06460	0.00788	0.25	0.00110	0.00903	0.00110	200	0.04980	1.01760	0.04980
TERRAZZO TRIM	LF	0.00334	0.01000	0.00334	0.09	0.00047	0.00140	0.00047	75	0.79888	2.65000	0.39944
CERAMIC TRIM	LF	0.00334	0.00492	0.00334	0.08	0.00047	0.00069	0.00047	50	0.79888	1.30380	0.39944
RUBBER / VINYL TRIM	LF	0.00425	0.09752	0.00223	0.19	0.00003	0.00061	0.00003	18	0.02847	0.65720	0.01424
INTERIOR STAIRS												
RAILINGS												
WOOD	LF	0.01293	0.11334	0.01293	0.42	0.00181	0.01585	0.00181	100	0.16835	3.87536	0.09210
METAL	LF	0.02105	0.08766	0.02105	0.59	0.00294	0.01226	0.00294	300	1.48174	1.84016	0.75160
IRON INT. STAIR RAILING	LF	0.04186	0.09836	0.04186	1.09	0.00585	0.01375	0.00585	200	2.18088	27.11480	1.10968
STEPS												
CONCRETE	SF	0.00767	0.00776	0.00767	0.19	0.00107	0.00108	0.00107	300	2.93605	16.84340	1.46803
WOOD	SF	0.01490	0.07770	0.01490	0.43	0.00208	0.01086	0.00208	100	0.46410	3.68456	0.23998
METAL	SF	0.01244	0.17262	0.01244	0.47	0.00174	0.02413	0.00174	300	2.16216	35.06480	1.09181
MASONRY STEPS (UNPNTD)	SF	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	400	1.59777	2.23660	0.79888
MASONRY STEPS (PAINTED)	SF	0.01532	0.04569	0.01532	0.41	0.00214	0.00639	0.00214	400	1.61909	2.30020	0.82020
CARPETED STEPS	SF	0.03974	3.39574	0.02352	4.28	0.00102	0.01050	0.00102	8	0.05239	5.36360	0.02620
RUBBER INTERIOR STEPS	SF	0.05551	1.21111	0.02858	2.44	0.00023	0.00763	0.00023	18	0.38007	8.16200	0.19003
TERRAZZO INTERIOR STEPS	SF	0.00603	0.01699	0.00603	0.16	0.00084	0.00238	0.00084	300	1.59774	4.50500	0.79887
INTERIOR HARDWARE												
HINGES												
BRASS	CT	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	60	0.21151	19.08000	0.21151
LOCKSET												
BRASS	CT	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	30	1.64840	124.02000	1.64840
DOOR CLOSER												
BRASS	CT	0.09319	16.99286	0.09319	19.20	0.00000	0.00000	0.00000	15	0.49413	90.10000	0.49413
DEADBOLT												
BRASS	CT	0.11000	9.30945	0.11000	11.91	0.00000	0.00000	0.00000	20	0.93938	79.50000	0.93938
WEATHER STRIPING												
BRASS	CT	0.07800	3.10315	0.07800	4.95	0.00000	0.00000	0.00000	20	0.66612	26.50000	0.66612
EXIT BOLT												
METAL	CT	0.14974	30.82480	0.14974	34.37	0.00000	0.00000	0.00000	25	2.05972	424.00000	2.05972

See NOTES on the last page of this table for Explanation of Column Headings

COMPONENT DESCRIPTION	um	PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%) By Resources labor	material	equipment	Washington D.C. Total	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS Annual Maintenance and Repair labor	material	equipment	yr	Replacement and High Costs Tasks labor	material	equipment
ARCHITECTURE												
WALL FINISHES												
GYPSUM AND PLASTER												
PLASTER	SF	0.02996	0.13543	0.02996	0.84	0.00419	0.01893	0.00419	300	0.23335	2.29278	0.12597
SHEETROCK (STIPPLED)	SF	0.02722	0.12380	0.02722	0.77	0.00381	0.01731	0.00381	300	0.03549	0.41976	0.02704
SHEETROCK (UNSTIPPLED)	SF	0.02722	0.12356	0.02722	0.77	0.00381	0.01727	0.00381	300	0.03497	0.31376	0.02678
STUCCO INT. WALL FINISH	SF	0.06670	0.15336	0.06670	1.73	0.00933	0.02144	0.00933	300	0.27846	0.95400	0.15750
MASONRY AND TILE												
CLAY BLOCK	SF	0.00046	0.03396	0.00046	0.02	0.00006	0.00195	0.00006	500	0.20150	9.60360	0.10075
CLAY BLOCK (PAINTED)	SF	0.02713	0.13689	0.02713	0.78	0.00379	0.01914	0.00379	500	0.22009	9.67356	0.11934
CONCRETE BLOCK	SF	0.00046	0.00116	0.00046	0.01	0.00006	0.00016	0.00006	500	0.20150	0.84376	0.10075
CONCRETE BLOCK (PAINTED)	SF	0.02713	0.12408	0.02713	0.77	0.00379	0.01735	0.00379	500	0.22009	0.91372	0.11934
CLAY BRICK	SF	0.00179	0.00177	0.00179	0.04	0.00025	0.00025	0.00025	500	1.09213	1.21900	0.54607
CONCRETE BRICK	SF	0.00176	0.00214	0.00176	0.04	0.00025	0.00030	0.00025	500	1.09213	1.47340	0.54607
FIRE BRICK	SF	0.00176	0.00145	0.00176	0.04	0.00025	0.00020	0.00025	500	1.09200	0.99640	0.54600
TILE	SF	0.01122	0.01089	0.01122	0.28	0.00157	0.00152	0.00157	100	1.21342	1.29320	1.21342
MASONITE INT. WALL FINISH	SF	0.05511	0.15557	0.05511	1.46	0.00770	0.02175	0.00770	200	0.08726	0.62540	0.08726
GLAZED CMU INT WALL FINISH	SF	0.00046	0.00782	0.00046	0.02	0.00006	0.00109	0.00006	500	0.20150	5.38056	0.10075
PAPER,PLASTIC,FABRIC												
FORMICA	SF	0.00131	0.03569	0.00131	0.07	0.00018	0.00499	0.00018	30	0.02925	4.24000	0.01463
NYLON	SF	0.00131	0.00892	0.00131	0.04	0.00018	0.00125	0.00018	30	0.02925	1.06000	0.02925
POLYESTER	SF	0.00131	0.00518	0.00131	0.04	0.00018	0.00072	0.00018	30	0.02925	0.61480	0.02925
VINYL	SF	0.00126	0.00535	0.00126	0.04	0.00018	0.00075	0.00018	30	0.02925	0.63600	0.02925
WALLPAPER	SF	0.00504	0.05422	0.00504	0.17	0.00023	0.00064	0.00023	20	0.02925	0.42400	0.02925
FABRIC INT. WALL FINISH	SF	0.00504	0.14369	0.00504	0.26	0.00023	0.00169	0.00023	20	0.02925	1.12360	0.02925
CARPETED INT. WALL FINISH	SF	0.05147	1.23685	0.03063	2.39	0.00137	0.01144	0.00137	8	0.06734	1.86560	0.03367
WOODS												
PLYWOOD	SF	0.02329	0.10602	0.02329	0.66	0.00326	0.01482	0.00326	80	0.04758	0.88616	0.03309
PLYWOOD (UNFINISHED)	SF	0.00126	0.00687	0.00126	0.04	0.00018	0.00096	0.00018	60	0.02899	0.81620	0.01450
TIMBER (FINISHED)	SF	0.02558	0.10602	0.02558	0.71	0.00358	0.01482	0.00358	80	0.31889	0.88616	0.16874
TIMBER (UNFINISHED)	SF	0.00356	0.00687	0.00356	0.09	0.00050	0.00096	0.00050	70	0.30030	0.81620	0.15015
PANEL (SOLID)	SF	0.02171	0.09934	0.02171	0.61	0.00303	0.01389	0.00303	200	0.42406	0.53636	0.22133
PANEL (LAMINATED)	SF	0.02171	0.09907	0.02171	0.61	0.00303	0.01385	0.00303	200	0.42406	0.34556	0.22133
BOARD (FINISHED)	SF	0.02116	0.09902	0.02116	0.60	0.00296	0.01384	0.00296	80	0.04758	0.31376	0.03309
BOARD (UNFINISHED)	SF	0.00023	0.00035	0.00023	0.01	0.00003	0.00005	0.00003	60	0.02899	0.24380	0.01450
WAINSCOT	SF	0.02747	0.12146	0.02747	0.77	0.00384	0.01698	0.00384	80	0.22742	2.71996	0.12374
METAL												
ALUMINUM	SF	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	100	0.07319	1.92920	0.03660
STEEL INT. FINISH (UNPNTD)	SF	0.00081	0.00885	0.00081	0.03	0.00011	0.00124	0.00011	200	0.56936	5.53320	0.28468
STEEL INT. FINISH (PNTD)	SF	0.23519	5.31727	0.23519	10.88	0.03288	0.74340	0.03288	200	0.57070	6.27520	0.30173
WIRE MESH WALL	SF	0.19975	0.46280	0.19975	5.19	0.02793	0.06470	0.02793	200	0.07609	3.37080	0.05069
LEAD-LINED INT WALL FINISH	SF	0.00000	0.00000	0.00000	0.00	0.00000	0.00000	0.00000	100	2.20662	12.61400	1.10331
GLASS												
GLASS BLOCKS	SF	0.00168	0.01762	0.00168	0.06	0.00024	0.00246	0.00024	300	1.04013	12.11580	0.52007
PLATE GLASS WALL - INT.	SF	0.00057	0.01357	0.00057	0.03	0.00008	0.00190	0.00008	200	0.09906	8.48000	0.04953
SPECIAL												
STONE	SF	0.00046	0.00262	0.00046	0.01	0.00006	0.00037	0.00006	500	0.20150	1.80200	0.10075
ACOUSTICAL TILE WALL	SF	0.15323	0.45569	0.15323	4.08	0.02142	0.06371	0.02142	90	0.37141	0.54060	0.19637
CORK TILE WALL	SF	0.06436	0.45524	0.03430	1.88	0.00059	0.00316	0.00059	16	0.35048	2.52280	0.17524
ASB.-ACOS FIRE RTD. TILE	SF	0.03886	0.11467	0.03886	1.03	0.00543	0.01603	0.00543	90	0.37141	0.64660	0.19637
FIBERGLASS PANELS, RIGID	SF	0.05580	0.16758	0.05580	1.49	0.00780	0.02343	0.00780	70	0.06540	1.77285	0.04750
CONCRETE												
UNFINISHED	SF	0.00880	0.00477	0.00880	0.21	0.00123	0.00067	0.00123	500	3.80861	4.63220	1.90431
CONCRETE (FINISHED)	SF	0.03469	0.12760	0.03469	0.95	0.00485	0.01784	0.00485	500	3.80861	4.63220	1.90431
FLOORING/FLOOR FINISH												
MASONRY & TILE PRODUCTS												
CERAMIC TILE	SF	0.00007	0.00010	0.00007	0.00	0.00001	0.00001	0.00001	50	0.18247	2.00340	0.18247
QUARRY TILE	SF	0.00007	0.00010	0.00007	0.00	0.00001	0.00001	0.00001	50	0.90337	1.72780	0.45169

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EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION		PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%) By Resources			Washington	ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS Annual Maintenance and Repair			Replacement and High Costs Tasks			
	um	labor	material	equipment	D.C. Total	labor	material	equipment	yr	labor	material	equipment
BRICK	SF	0.00331	0.01167	0.00331	0.09	0.00046	0.00163	0.00046	60	0.43604	2.65731	0.21802
MARBLE	SF	0.00016	0.00022	0.00016	0.00	0.00002	0.00003	0.00002	50	0.90337	7.52600	0.45169
WOODS												
WOOD PARQUETRY	SF	0.00962	0.06276	0.00962	0.29	0.00135	0.00877	0.00135	40	0.19980	2.12000	0.09990
MAPLE	SF	0.00830	0.06363	0.00830	0.26	0.00116	0.00890	0.00116	40	0.03804	2.19420	0.01902
PLYWOOD	SF	0.00122	0.00459	0.00122	0.03	0.00017	0.00064	0.00017	40	0.02054	0.39220	0.01027
METAL												
STEEL SHEET	SF	0.00155	0.13385	0.00155	0.17	0.00022	0.01871	0.00022	30	1.93258	3.28600	0.96629
METAL GRATING	SF	0.00155	0.13385	0.00155	0.17	0.00022	0.01871	0.00022	30	1.93258	3.24360	0.96629
SPECIAL SURFACES												
CARPET	SF	0.03243	1.17190	0.01633	1.89	0.00003	0.00236	0.00003	8	0.05200	1.86560	0.02600
CORK FLOOR TILE	SF	0.00573	0.27980	0.00295	0.41	0.00002	0.00100	0.00002	16	0.03237	1.59000	0.01619
SYNTHETIC SURFACE												
LINOLEUM	SF	0.00644	0.36130	0.00233	0.46	0.00003	0.00116	0.00003	18	0.02977	2.49100	0.01489
VINYL TILE	SF	0.00476	0.19987	0.00247	0.31	0.00002	0.00064	0.00002	18	0.03237	1.37800	0.01619
RUBBER TILE	SF	0.00476	0.57500	0.00476	0.69	0.00002	0.00185	0.00002	18	0.03237	3.96440	0.03237
VINYL SHEET	SF	0.05551	0.36098	0.02858	1.59	0.00023	0.00112	0.00023	18	0.38007	2.49100	0.19003
CONCRETE												
CONCRETE (UNFINISHED)	SF	0.00162	0.00095	0.00162	0.04	0.00023	0.00013	0.00023	75	0.09425	0.50562	0.04713
CONCRETE (FINISHED)	SF	0.00205	0.05644	0.00184	0.10	0.00029	0.00789	0.00026	75	0.09841	0.50562	0.04921
TERRAZZO												
TERRAZZO, PRECAST	SF	0.00162	0.01000	0.00162	0.05	0.00023	0.00140	0.00023	75	0.09841	5.30000	0.04921
BITUMINOUS												
BITUMINOUS	SF	0.03197	0.12080	0.01658	0.83	0.00017	0.00040	0.00017	15	0.16324	0.62540	0.08162
CEILINGS												
GYPSUM AND PLASTER												
PLASTER	SF	0.02941	0.13582	0.02941	0.83	0.00411	0.01899	0.00411	300	0.23335	2.35638	0.12597
SHEETROCK (STIPPLED)	SF	0.02722	0.12396	0.02722	0.77	0.00381	0.01733	0.00381	300	0.03549	0.48972	0.02704
SHEETROCK (UNSTIPPLED)	SF	0.02722	0.12372	0.02722	0.77	0.00381	0.01730	0.00381	300	0.03497	0.38372	0.02678
STUCCO INT. CEILING FINISH	SF	0.06670	0.15336	0.06670	1.73	0.00933	0.02144	0.00933	300	0.27846	0.95400	0.15750
MASONRY AND TILE												
ACOUSTIC TILE	SF	0.00433	0.01130	0.00433	0.11	0.00061	0.00158	0.00061	70	0.02340	1.12095	0.01170
ACOUSTIC TILE (DROPPED)	SF	0.00119	0.00669	0.00119	0.03	0.00017	0.00094	0.00017	70	0.00754	1.42040	0.00377
CERAMIC (PAN)	SF	0.00059	0.00010	0.00059	0.00	0.00008	0.00001	0.00008	100	3.90988	1.72780	1.95494
CERAMIC (TILE)	SF	0.00059	0.00100	0.00059	0.00	0.00008	0.00014	0.00008	100	3.90988	2.00340	1.95494
PAPER, PLASTIC, FABRIC												
PAPER	SF	0.00504	0.05422	0.00504	0.17	0.00023	0.00064	0.00023	20	0.02925	0.42400	0.02925
PLASTIC	SF	0.00126	0.00535	0.00126	0.04	0.00018	0.00075	0.00018	30	0.02925	0.63600	0.02925
FABRIC	SF	0.00126	0.00518	0.00126	0.03	0.00018	0.00072	0.00018	30	0.02925	0.61480	0.02925
FORMICA CEILING FINISH	SF	0.00126	0.03569	0.00126	0.07	0.00018	0.00499	0.00018	30	0.02925	4.24000	0.02925
WOODS												
WOOD (FINISHED)	SF	0.02193	0.02375	0.02193	0.54	0.00307	0.00332	0.00307	80	0.31889	0.94976	0.16874
WOOD (UNFINISHED)	SF	0.00356	0.00687	0.00356	0.09	0.00050	0.00096	0.00050	60	0.30030	0.81620	0.30030
METALS												
ALUMINIUM PANELS	SF	0.04040	0.56117	0.04040	1.52	0.00565	0.07846	0.00565	100	0.06565	3.08460	0.03536
METAL INT. FINISH (UNPNTD)	SF	0.00081	0.00885	0.00081	0.03	0.00011	0.00124	0.00011	200	0.57473	5.53320	0.28737
GLASS												
PLATE GLASS (MOUNTED)	SF	0.00052	0.01578	0.00026	0.03	0.00007	0.00221	0.00004	60	0.09906	10.85440	0.04953
PLATE GLASS (SUSPENDED)	SF	0.00259	0.19920	0.00130	0.26	0.00036	0.02785	0.00018	60	0.02015	10.85440	0.01008
SINGLE UNIT GLASS SKYLIGHT	SF	0.02149	0.35988	0.02149	0.87	0.00300	0.05031	0.00300	300	0.17978	19.61000	0.08989
SINGLE UNIT GLASS SKYLIGHT	SF	0.02138	0.30152	0.02138	0.81	0.00299	0.04216	0.00299	300	1.22586	16.43000	0.61293
SPECIAL SURFACES												
ACOUSTIC TILE SPECIAL PUR.	SF	0.00119	0.01026	0.00119	0.04	0.00017	0.00143	0.00017	65	0.00754	1.84440	0.00377
ACOUSTIC TILE (FIRE RATED)	SF	0.00119	0.00982	0.00119	0.04	0.00017	0.00137	0.00017	65	0.00754	1.79140	0.00377
ASB.-ACOS. FIRE RTD. TILE	SF	0.03886	0.11467	0.03886	1.03	0.00543	0.01603	0.00543	65	0.37141	0.64660	0.19637
FIBERGLASS PANELS, RIGID	SF	0.05580	0.16758	0.05580	1.49	0.00780	0.02343	0.00780	70	0.06536	1.77285	0.04748
CONCRETE												
CONCRETE (UNFINISHED)	SF	0.00162	0.00095	0.00162	0.04	0.00023	0.00013	0.00023	500	3.80861	4.63220	1.90431

See NOTES on the last page of this table for Explanation of Column Headings

EPS BASED MAINTENANCE AND REPAIR COST DATA FOR USE IN LIFE CYCLE COST ANALYSIS ($ PER UNIT MEASURE)

COMPONENT DESCRIPTION		PRESENT WORTH OF ALL 25 YEAR MAINTENANCE AND REPAIR COSTS (d=10%)				ANNUAL MAINTENANCE AND REPAIR PLUS HIGH COST REPAIR AND REPLACEMENT COSTS						
		By Resources			Washington	Annual Maintenance and Repair			Replacement and High Costs Tasks			
	um	labor	material	equipment	D.C. Total	labor	material	equipment	yr	labor	material	equipment
CONCRETE (FINISHED)	SF	0.00205	0.05644	0.00184	0.10	0.00029	0.00789	0.00026	500	3.80861	4.63220	1.90431

See NOTES on the last page of this table for Explanation of Column Headings

APPENDIX C:

TECHNICAL BULLETIN INDEX FOR ENGINEERED PERFORMANCE STANDARDS

TB No.	Date	Title
TB 420-1	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Engineers Manual (NAVDOCKS P-700.0)
TB 420-2	5 Oct 72	Engineered Performance Standards Public Works Maintenance: General Handbook (NAVDOCKS P-701.0)
TB 420-3	5 Oct 72	Engineered Performance Standards Public Works Maintenance: General Formulas
TB 420-4	1 Mar 82	Tri-Service Coordination of the Carpentry Handbook
TB 420-5	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Carpentry Formulas
TB 420-6	1 Feb 82	Tri-Service Coordination of the Electric, Electronic Handbook
TB 420-7	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Electric, Electronic Formulas
TB 420-8	1 Feb 82	Tri-Service Coordination of the Heating, Cooling and Ventilating Handbook
TB 420-9	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Heating, Cooling, Ventilating Formulas
TB 420-10	1 Apr 81	Engineered Performance Standards Real Property Maintenance Activities Janitorial Handbook
TB 420-11	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Janitorial Formulas
TB 420-12	1 Apr 83	Engineered Performance Standards Real Property Maintenance Activities Machine Shop, Machine Repairs Handbook
TB 420-13	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Machine Shop and Repairs Formulas
TB 420-14	Sep 80	Engineered Performance Standards Real Property Maintenance Activities: Masonry Handbook
TB 420-15	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Masonry Formulas

TB 420-16	1 Apr 81	Engineered Performance Standards Real Property Maintenance Activities: Moving, Rigging Handbook
TB 420-17	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Moving, Rigging Formulas
TB 420-18	1 Nov 78	Engineered Performance Standards Real Property Maintenance Activities: Paint Handbook
TB 420-19	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Paint Formulas
TB 420-20	1 Aug 83	Engineered Performance Standards Real Property Maintenance Activities: Pipefitting, Plumbing Handbook
TB 420-21	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Pipefitting, Plumbing Formulas
TB 420-22	1 Sep 80	Engineered Performance Standards Public Works Maintenance: Roads, Grounds, Pest Control, Refuse Collection Handbook
TB 420-24	1 Mar 84	Engineered Performance Standards Real Property Maintenance Activities: Sheet Metal, Structural Iron and Welding Handbook
TB 420-25	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Sheet Metal, Structural Iron and Welding Handbook
TB 420-26	1 Nov 79	Engineered Performance Standards Real Property Maintenance Activities: Trackage Handbook
TB 420-27	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Trackage Formulas
TB 420-28	1 Nov 79	Engineered Performance Standards Real Property Maintenance Activities: Wharfbuilding Handbook
TB 420-29	5 Oct 72	Engineered Performance Standards Public Works Maintenance: Wharfbuilding Formulas
TB 420-30	1 Aug 79	Engineered Performance Standards Real Property Maintenance Activities: Emergency/Service Handbook
TB 420-31	1 Dec 73	Engineered Performance Standards Real Property Maintenance Activities: Planner and Estimator's Workbook (Instructor's Manual) (S&I OCE)
TB 420-32	1 Mar 80	Engineered Performance Standards Real Property Maintenance Activities: Planner and Estimator's Workbook, Student's Manual

TB 420-33	1 Aug 83	Engineered Performance Standards Real Property Maintenance Activities: Unit Price Standards Handbook
TB 420-34	1 Mar 84	Engineered Performance Standards Real Property Maintenance Activities: Preventive/Recurring Maintenance Handbook
TB 420-35	1 Apr 81	Tri-Service Coordination of the Moving, Rigging Handbook
TB 420-51	30 Oct 73	Engineered Performance Standards Public Works Maintenance: Facilities Engineering Management of Maintenance Painting of Facilities

APPENDIX D:

GEOGRAPHICAL LOCATION ADJUSTMENT FACTORS

State	Location	ACF Index
Alabama	State Average	.86
	Birmingham	.96
	Mobile	.86
	Montgomery	.76
	Anniston Army Depot	.81
	Huntsville	.88
	Fort McClellan	.80
	Redstone Arsenal	.88
	Fort Rucker	.80
Alaska	State Average	2.25
	Anchorage	1.92
	Delta Junction	2.70
	Fairbanks	2.13
	Adak	3.88
	Aleutian Islands	3.86
	Anchorage NSGA	1.92
	Barrow	4.18
	Burnt Mtn.	6.86
	Clear	3.10
	Eielson AFB	2.13
	Elmendorf AFB	1.92
	Galena	3.73
	Fort Greely	2.70
	Fort Richardson	1.92
	Fort Wainwright	2.13
Arizona	State Average	1.02
	Flagstaff	1.02
	Phoenix	.99
	Tucson	1.05
	Fort Huachuca	1.22
	Yuma Proving Ground	1.31
	Yuma	1.31
Arkansas	State Average	.89
	Pinebluff	.93
	Little Rock	.83
	Fort Smith	.92
	Fort Chaffee	.92
	Pine Bluff Arsenal	.93
California	State Average	1.21
	Los Angeles	1.20
	San Diego	1.18
	San Francisco	1.25
	Beale	1.28
	Bridgeport NWTC	1.27
	Castle	1.13
	Centerville Beach	1.32
	Desert Area	1.18
	Edwards AFB	1.30

State	Location	ACF Index
California (Cont'd)	El Centro	1.27
	George AFB	1.31
	Fort Hunter Liggett	1.29
	Fort Irwin	1.20
	Le Moore NAS	1.20
	March AFB	1.18
	Mather AFB	1.17
	McClellan AFB	1.17
	Monterey Area	1.23
	Presidio of Monterey	1.23
	Norton AFB	1.16
	Oakland Army Base	1.33
	Fort Ord	1.24
	Port Huenema Area	1.20
	Riverside	1.18
	Sacramento	1.15
	Sacramento Army Depot	1.15
	Presidio of San Francisco	1.25
	San Nicholas Island	2.59
	Sharpe Army Depot	1.13
	Sierra Army Depot	1.33
	Stockton	1.15
	Travis AFB	1.27
	Vandenburg AFB	1.38
Colorado	State Average	.98
	Colorado Springs	.94
	Denver	1.04
	Pueblo	.96
	Fort Carson	1.01
	Fitzsimmons AMC	1.06
	Pueblo Army Depot	.96
	Peterson AFB	.94
	Rocky Mountain Arsenal	1.06
Connecticut	State Average	1.13
	Bridgeport	1.16
	Hartford	1.10
	New London	1.14
Delaware	State Average	.99
	Dover	1.04
	Lewes	.98
	Milford	.96
	Lewes NF	1.04
	Dover AFB	1.04
District of Columbia	Washington	1.03
	Fort McNair	1.03
	Walter Reed AMC	1.03
Florida	State Average	.89
	Miami	.95
	Panama City	.92
	Tampa	.79
	Cape Canaveral	.96
	Cape Kennedy	.96

State	Location	ACF Index
Florida (Cont'd)	Gulf Coast	.85
	Homestead AFB	.88
	Homestead	.88
	Jacksonville Area	.85
	Key West NAS	1.08
	Orlando	.80
	Pensacola Area	.85
	McDill AFB	.77
	Eglin AFB	.77
	Tyndall AFB	.92
Georgia	State Average	.80
	Albany	.82
	Atlanta	.87
	Macon	.70
	Athens	.90
	Atlanta-Marietta	.93
	Fort Benning	.71
	Columbus	.71
	Fort Gillem	.87
	Fort Gordon	.94
	Kings Bay	.93
	Fort McPherson	.87
	Fort Stewart	.84
Hawaii	State Average	1.28
	Hawaii	1.29
	Honolulu	1.27
	Maui	1.29
	Alimanu	1.27
	Barbars Point NAS	1.34
	Fort Debussy	1.27
	EWA Beach Area	1.34
	Helemano	1.34
	Hickam Army Air Field	1.27
	Kaneohe MCAS	1.34
	Moanalua	1.27
	Pearl City	1.27
	Pearl Harbor	1.27
	Pohakuloa	1.32
	Schofield Barracks	1.27
	Fort Shafter	1.27
	Tripler AMC	1.27
	Wheeler Army Air Field	1.34
Idaho	State Average	1.11
	Boise	1.05
	Idaho Falls	1.08
	Mountain Home	1.19
	Mountain Home AFB	1.20
Illinois	State Average	1.03
	Belleville	.96
	Chicago	1.09
	Rock Island	1.03
	Rock Island Arsenal	1.06

State	Location	ACF Index
Illinois (Cont'd)	St. Louis Support Ctr	.96
	Savannah Army Depot	1.05
	Scott AFB	1.03
	Fort Sheridan	1.10
Indiana	State Average	.99
	Indianapolis	1.03
	Logansport	.99
	Madison	.94
	Fort Benjamin Harrison	1.07
	Crane	1.10
	Crane AAP	1.10
	Grissom AFB	1.06
	Indiana AAP	1.02
	Jefferson Proving Ground	.94
Iowa	State Average	1.02
	Burlington	1.04
	Cedar Rapids	.98
	Des Moines	1.05
	Iowa AAP	1.06
Kansas	State Average	.94
	Manhattan	.97
	Topeka	.96
	Wichita	.88
	Kansas AAP	.94
	Fort Leavenworth	.94
	Fort Riley	.97
	Sunflower AAP	.97
Kentucky	State Average	.96
	Bowling Green	.99
	Lexington	.96
	Louisville	.93
	Fort Campbell	.93
	Fort Knox	.99
	Lexington/Bluegrass Army Depot	1.06
	Louisville NAS	.93
Louisiana	State Average	.92
	Alexandria	.87
	New Orleans	.94
	Shreveport	.94
	Barksdale AFB	.94
	England AFB	.87
	Gulf Outport New Orleans	.94
	Louisiana AAP	.94
	Fort Polk	.94
Maine	State Average	.93
	Bangor	.85
	Caribou	.99
	Portland	.94
	Brunswick	.93
	Cutler	.98
	Northern Area	1.17
	Winter Harbor	.98

State	Location	ACF Index
Maryland	State Average	.97
	Baltimore	.95
	Fredrick	.94
	Lexington Park	1.01
	Aberdeen Proving Ground	.94
	Annapolis	1.03
	Fort Detrick	.94
	Harry Diamond Lab	1.00
	Fort Meade	.95
	Patuxent River Area	1.08
	Fort Ritchie	.90
Massachusetts	State Average	1.10
	Boston	1.13
	Fitchburg	1.08
	Springfield	1.08
	Army Mtls & Mech Research Ctr	1.13
	Fort Devens	1.15
	Natick Research & Development Ctr	1.13
	South Weymouth	1.13
Michigan	State Average	1.06
	Bay City	1.02
	Detroit	1.14
	Marquette	1.03
	Detroit Arsenal	1.14
	Northern Area	1.25
	Republic (Elfcom)	1.10
	Selfridge AFB	1.14
Minnesota	State Average	1.08
	Duluth	1.05
	Minneapolis	1.09
	St. Cloud	1.10
	Twin Cities AAP	1.09
Mississippi	State Average	.84
	Biloxi	.87
	Columbus	.81
	Jackson	.84
	Columbus AFB	.81
	Gulfport Area	.87
	Meridian	.92
Missouri	State Average	.92
	Kansas City	.92
	St. Louis	.99
	Rolla	.85
	Lake City AAP	.93
	Fort Leonard Wood	.91
Montana	State Average	1.15
	Billings	1.15
	Butte	1.18
	Great Falls	1.12
	Malmstrom AFB	1.12
Nebraska	State Average	1.03
	Grand Island	1.00

State	Location	ACF Index
Nebraska (Cont'd)	Lincoln	1.05
	Omaha	1.05
	Offutt AFB	1.05
Nevada	State Average	1.18
	Hawthorne	1.26
	Las Vegas	1.13
	Reno	1.15
	Fallon	1.28
	Hawthorne AAP	1.26
	Nellis AFB	1.13
New Hampshire	State Average	1.09
	Concord	1.06
	Nashua	1.06
	Portsmouth	1.14
	Cold Regions Lab	1.17
New Jersey	State Average	1.08
	Newark	1.11
	Red Bank	1.08
	Trenton	1.06
	Bayonne	1.10
	Bayonne Mil Ocean Term	1.09
	Fort Dix	1.03
	Earle	1.10
	Lakehurst	1.05
	Fort Monmouth	1.09
	Picatinny Arsenal	1.20
New Mexico	State Average	1.03
	Alamogordo	.99
	Albuquerque	1.03
	Gallup	1.06
	Holloman AFB	1.05
	Kirtland AFB	1.03
	White Sands Missile Range	1.09
	Fort Wingate	1.06
New York	State Average	1.12
	Albany	1.07
	New York City	1.24
	Syracuse	1.05
	Brooklyn	1.24
	Fort Drum	1.18
	Fort Hamilton	1.24
	Seneca Army Depot	1.15
	U.S. Military Academy	1.17
	Watervliet Arsenal	1.07
North Carolina	State Average	.76
	Fayetteville	.76
	Greensboro	.75
	Wilmington	.78
	Fort Bragg	.76
	Camp Lejeune Area	.86
	Cherry Point	.86
	Goldsboro	.77

State	Location	ACF Index
North Carolina (Cont'd)	Pope AFB	.82
	Seymour AFB	.77
	Sunny Point Mil Ocean Term	.78
North Dakota	State Average	1.03
	Bismarck	1.02
	Grand Forks	.98
	Minot	1.10
	Grand Forks AFB	.98
	Stanley R. Hicklesen CPX	1.03
	Minot AFB	1.12
Ohio	State Average	1.00
	Columbus	1.03
	Dayton	.98
	Youngstown	.99
	Cleveland	1.14
	Wright-Patterson AFB	.98
Oklahoma	State Average	.93
	Lawton	.90
	McAlester	.91
	Oklahoma City	.98
	Altus AFB	.94
	Enid	1.01
	McAlester AAP	.91
	Fort Sill	.90
Oregon	State Average	1.05
	Pendleton	1.08
	Portland	1.07
	Salem	.99
	Charleston	1.11
	Coos Head	1.08
	Umatilla Army Depot	1.18
Pennsylvania	State Average	1.00
	Harrisburg	.91
	Philadelphia	1.05
	Pittsburgh	1.04
	Carlisle Barracks	.93
	New Cumberland Army Depot	.91
	Fort Indiantown Gap	1.07
	Letterkenny Army Depot	1.07
	Mechanicsburg Area	.91
	Tobyhanna Army Depot	1.14
	Warminster Area	1.04
Rhode Island	State Average	1.11
	Bristol	1.13
	Newport	1.11
	Providence	1.10
	Davisville	1.17
South Carolina	State Average	.82
	Charleston	.81
	Columbia	.82
	Myrtle Beach	.84
	Beaufort Area	.89

State	Location	ACF Index
South Carolina (Cont'd)	Charleston AFB	.81
	Fort Jackson	.82
	Sumter	.80
South Dakota.	State Average	.95
	Aberdeen	.95
	Sioux Falls	.94
	Rapid City	.96
	Ellsworth AFB	.98
Tennessee	State Average	.84
	Chattanooga	.86
	Kingsport	.72
	Memphis	.95
	Arnold AFB	.90
	Milan AAP	.98
	Holston AAP	.71
Texas	State Average	.85
	San Angelo	.76
	San Antonio	.86
	Fort Worth	.93
	Fort Bliss	.96
	Carswell AFB	.93
	Chase Field - Beeville	.97
	Corpus Christi Army Depot	.92
	Corpus Christi	.92
	Dallas	.93
	Dyess AFB	.94
	Fort Hood	.89
	Kingsville	.99
	Red River Army Depot	.78
	Fort Sam Houston	.86
	William Beaumont AMC	.96
	Bergstrom AFB	.95
	Brooks AFB	.86
	Randolph AFB	.86
	Kelly AFB	.86
	Lackland AFB	.86
Utah	State Average	1.03
	Ogden	1.05
	Salt Lake City	1.00
	Tooele	1.06
	Dugway Proving Ground	1.03
	Hill AFB	1.07
	Tooele Army Depot	1.05
Vermont	State Average	.99
	Burlington	1.00
	Montpelier	1.00
	Rutland	.96
Virginia	State Average	.95
	Norfolk	.95
	Radford	.95
	Richmond	.94
	Arlington	1.04

State	Location	ACF Index
Virginia (Cont'd)	Arlington Hall Station	1.04
	Arlington National Cemetery	1.04
	Fort Belvoir	1.04
	Cameron Station	1.04
	Dahlgren	1.10
	Fort Eustis	.96
	Humphreys Engineer Center	1.03
	Fort A. P. Hill	.92
	Fort Lee	.93
	Fort Monroe	.94
	Fort Myer	1.03
	Norfolk-Newport News Area	.95
	Fort Pickett	.98
	Quantico	1.03
	Nadford AAP	1.02
	Port Story	.95
	Vint Hill Farms Station	1.08
Washington	State Average	1.09
	Spokane	1.08
	Tacoma	1.07
	Yakima	1.11
	Fairchild AFB	1.13
	Jim Creek	1.34
	Fort Lewis	1.07
	Pacific Beach	1.27
	Puget Sound Area	1.15
	Seattle Area	1.12
	Widbey Island	1.12
	Yakima Firing Center	1.18
West Virginia	State Average	.95
	Bluefield	.92
	Clarksburg	.95
	Charleston	.99
	Sugar Grove	1.15
Wisconsin	State Average	1.06
	LaCrosse	1.04
	Madison	1.02
	Milwaukee	1.13
	Badger AAP	1.06
	Clam Lake	1.20
	Fort McCoy	1.11
Wyoming	State Average	1.08
	Casper	1.07
	Cheyenne	1.10
	Laramie	1.08
	F. E. Warren AFB	1.10

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